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FINAL REPORT

COLLATERAL DAMAGE

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HI-361-RR/5

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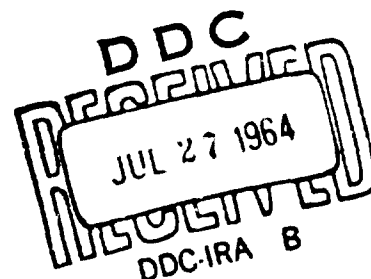
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SUMMARY

This paper presents the methodology and results of a limited study undertaken to determine collateral population damage from weapons aimed at strategic military bases and to roughly estimate the cost of blast shelters to protect everyone at risk. The study had the following assumptions and criteria:

1. Targets -- 57 operational SAC bases taken from unclassified sources and located on Sectional Aeronautical Charts, Coast and Geodetic Survey.
2. Weapons -- Optimum air burst, 0-CEP, with ground zero occurring at the center of each base. Computations were run for 1, 2, 4, 8, 16 and 64 MT size weapons, one weapon delivered per base (range of from 57 to 3648 total MT's delivered).
3. Damage Model -- A roughly Gaussian relationship between per cent mortalities and peak overpressure in which the 0.5 kill probability (P_k) for the unprotected was taken at 10 psi with no survivors at 20 psi. In each city the model assumes that the population at risk is so distributed that the kill probability for the total population is equal to the P_k at the population center.
4. Cost Model -- The cost per blast shelter space is equal to $\$50 + \$20 \sqrt{p}$, where p is the designed overpressure rating in pounds per square inch.

Four sets of calculations are given. The first (Appendix A, labeled "Rough Computations") contains a detailed listing of bases and cities at risk, plus mortalities computed using census data, target to city distances, and the damage model selected. The second (Appendix B, labeled "Detail Calculations for Ten Targets") contains the results of refined calculations for some large cities in which each census tract is treated as a population center. The third (Appendix C, labeled "Adjusted Computations") contains the results of modifying the first set of computations according to the results of the refined computations. The fourth (Appendix D, labeled "Blast Shelter Cost Computations") contains blast shelter cost calculations for protection against 1-MT and 8-MT attacks.

The significant results of the various computations are as follows:

1. Collateral damage for the unprotected population around 57 SAC bases:

<u>Pop. at Risk</u> <u>(Millions)</u>	<u>Estimated Mortalities (Millions)</u>					
	<u>1 MT</u>	<u>2 MT</u>	<u>4 MT</u>	<u>8 MT</u>	<u>16 MT</u>	<u>64 MT</u>
12.0	1.2	1.7	2.4	3.5	4.8	7.6

2. Cost to provide a blast shelter space for all at risk to more than 5 psi:

Against a 1-MT attack -- \$320,000,000 (approximately 2,700,000 spaces)

Against an 8-MT attack -- \$825,000,000 (approximately 6,600,000 spaces)

3. Ten per cent of the targets account for 20% to 40% of the people at risk depending on weapon size and 40% of the mortalities. Twenty per cent of the targets account for 35% to 55% of the people at risk depending on weapon size and 60% of the mortalities.

The paper also concludes that some additional work might be worthwhile to indicate the effects of aiming errors (finite CEP's) on collateral damage.

COLLATERAL DAMAGE

Introduction

Among the various possible hardened and/or dispersed shelter programs are those which are designed to limit collateral damage resulting from weapons aimed only at military targets. Preparatory to determining the effectiveness and cost of such programs, it is necessary to undertake some basic map exercises and computations to determine the current vulnerability of the country to a range of counterforce attacks. This paper presents the methodology and results of one set of collateral damage calculations and blast shelter cost calculations.

Targets

Targets selected for computation of damages consist of 57 air bases located within the continental United States. These are distributed as shown on Figure 1 and are listed in Appendices A and C. This list was compiled from various unclassified sources.

The air bases are divided into two groups designated A_0 priority and A_1 priority.* An A_0 priority target is one housing or supporting ICBM facilities. An A_1 priority target is a SAC base.

Hypothetical attacks were run on each base assuming 1, 2, 4, 8, 16, and 64 MT air burst weapons delivered on target. Ground zeros were assumed to occur at the midpoint of the longest runway as shown on Sectional Aeronautical Charts compiled by the Coast and Geodetic Survey, U.S. Dept. of Commerce. Where runways were not shown, the GZ was taken at the center of the symbol designating the air base.

Damage Model

Two basic assumptions were used to determine mortalities from any size weapon. First, the per cent mortalities vs. peak overpressure relationship was assumed to be Gaussian for all prompt weapons effects roughly approximating the Japanese experiences. In this relationship, for an unprotected population 50% mortalities ($P_k = 0.5$) from blast effects occur at a distance from GZ corresponding to 10 psi. Above 20 psi there are no survivors. Second, for small population centers we assume that the population of any urban concentration is so distributed that the probability of kill for the total concentration is equal to the P_k at the population center. Ten large populated areas near the bases are examined in detail.

Using current distance-overpressure relationships and scaling laws,** it is now possible to calculate damage from the various weapon sizes (Table 1).

*"The Probable Fallout Threat Over the Continental United States," E.D. Callahan, et al., Technical Operations Inc., TO-R 60-13, Dec. 1960.

**"Effects of Nuclear Weapons," AEC, 1962

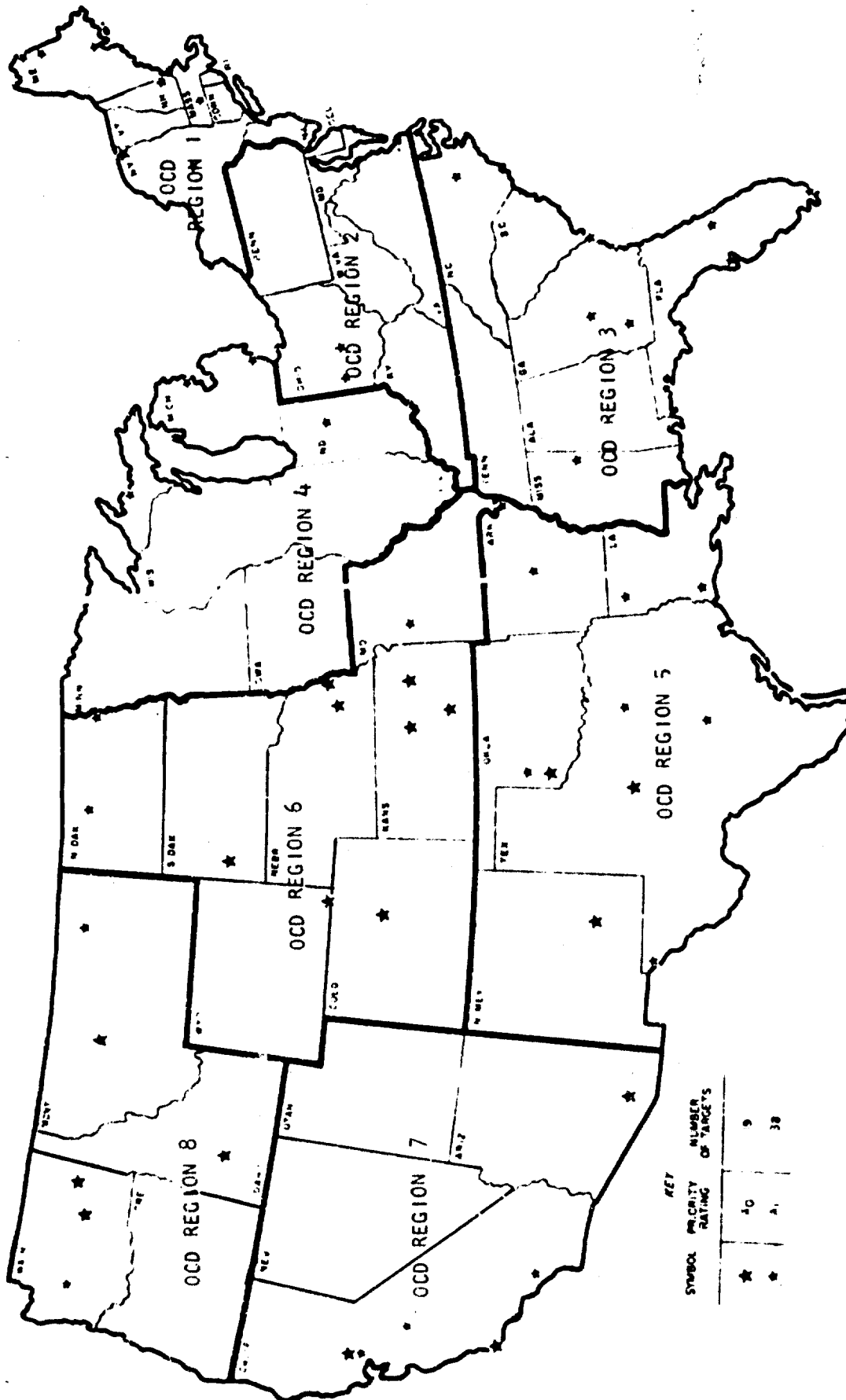
Figure 1. TARGET LOCATIONS

TABLE 1

<u>COLLATERAL DAMAGE - % BLAST MORTALITIES</u>							
(psi)	P_k (kill probability)	Distance (Miles) from GZ (airburst) to Population Center					
		1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
20	1.00	1.75	2.2	2.8	3.5	4.5	7.0
19	.95	1.80	2.3	2.9	3.6	4.6	7.2
18	.90	1.90	2.4	3.0	3.8	4.8	7.5
17	.85	1.95	2.5	3.1	3.9	4.9	7.7
16	.80	2.00	2.6	3.2	4.0	5.1	8.0
15	.75	2.1	2.7	3.3	4.2	5.3	8.3
14	.70	2.2	2.8	3.5	4.4	5.6	8.7
13	.65	2.3	2.9	3.7	4.6	5.8	9.2
12	.60	2.4	3.1	3.9	4.9	6.1	9.6
11	.55	2.6	3.3	4.1	5.2	6.5	10.2
10	.50	2.7	3.5	4.3	5.5	6.9	10.9
9	.45	2.9	3.7	4.6	5.8	7.4	11.6
8	.40	3.2	4.0	5.0	6.3	8.0	12.7
7	.35	3.5	4.4	5.5	6.9	8.8	13.8
6	.30	3.8	4.8	6.0	7.7	9.7	15.4
5	.20	4.3	5.5	6.9	8.7	11.0	17.4
4	.10	5.1	6.4	8.0	10.2	12.8	20.4
3	.05	6.2	7.8	9.8	12.5	15.7	25.0

Calculation Procedures

The preliminary or "first cut" computations were done as follows. Using the Aeronautical Charts, all urban and urbanized places at risk were located and listed by name and distance from the GZ. In this first try, the list is limited to places within 15 miles of the target except for large cities within a 25-mile radius. Population figures for each place were obtained from census data.* In order to "pick up" as much of the rural population as possible, towns were also counted and included at 2000 persons per town. These were assumed to be uniformly distributed within a 15-mile radius circle. The P_k assigned to the towns is "weighted" on an area basis. Using the data given in Table 1, mortalities for each place were calculated by multiplying the total population by the proper P_k .† All of the detail work may be found in Appendix A. The results showing the vulnerability to blast of about 14 million people at risk are summarized in the following table.

*United States Census Population 1960, United States Summary, United States Dept. of Commerce, Bureau of the Census.

†Minimum P_k was chosen at .01.

TABLE 2
COLLATERAL BLAST DAMAGE FOR 57 SAC BASES

Pop. at risk (millions)	Mortalities (millions)					
	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
14.00	0.83	1.41	2.23	3.32	4.73	7.94
% 100	5.9	10.0	16.0	23.7	33.8	56.7

During these computations it appeared that some serious deviations from the model might have been introduced due to the simple treatment of large urbanized areas especially where: a) an urbanized area was not well defined, or b) the GZ was within or close to the effective radius* of the city, or c) the city was very far (15-plus miles) from GZ. In addition, it was very possible that the distribution assumption for large places was grossly inaccurate.

As a result, it was decided to select a few places (10 in all) and subject them to a more detailed analysis. These were selected primarily according to population; as many in the 250,000 and over category as time would allow. For this analysis each census tract within 20 miles of ground zero was considered as a separate population center. The location and population of the tracts were obtained from the various volumes of the National Location Code prepared by the Bureau of the Census. Measurements were made to the geographical center of each tract and population figures summed for tracts equidistant from GZ. P_k 's were then applied to sums according to Table 1. The detailed calculations can be found in Appendix B.

A comparison of the calculation procedures (Table 3) indicates that the rough computation is accurate especially in the medium weapons range (2-8 MT) and for wide variations in population (Detroit), and for distance from GZ (Miami). For highly concentrated places** it is very accurate.

On the basis of the detailed figures it was decided to go back over the first approximation and make more adjustments. These were applied as follows.

1. Across-the-board adjustment of population at risk and mortalities. The population-at-risk comparison for all places except Miami and Detroit indicates that a 10% increase in the rough figures is called for.

*Effective radius (designated R_0 in Appendix A) is the radius of a circle whose area is equal to the urban area figures given in the census information.

**Cities like Tacoma where the urban fringe population drops off sharply away from the central city.

TABLE 3
COMPARISON OF CALCULATION METHODS

A₁ Priority Targets

<u>Lowry AFB, Denver, Colorado</u>		d = 5.2 mi.					
Pop. at risk (thousands)		Mortalities (thousands)					
		1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Rough Calc.	808	72	193	315	451	628	806
Detail Calc.	813	157	225	303	396	498	677

<u>McConnell AFB, Wichita, Kansas</u>		d = 5.5 mi.					
Pop. at risk (thousands)		Mortalities (thousands)					
		1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Rough Calc.	323	36	59	105	153	222	316
Detail Calc.	362	62	98	138	185	236	312

<u>Fairchild AFB, Spokane, Washington</u>		d = 12.5 mi.					
Pop. at risk (thousands)		Mortalities (thousands)					
		1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Rough Calc.	257	11	12	15	25	42	116
Detail Calc.	263	7	8	14	29	52	130

A₀ Priority Targets

<u>March AFB, San Bernardino, Riverside, California</u>		d = 8.8 mi. *					
Pop. at risk (thousands)		Mortalities (thousands)					
		1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Rough Calc.	398	5	6	37	81	139	274
Detail Calc.	470	10	14	27	47	149	206

<u>Homestead AFB, Homestead (Miami), Florida</u>		d (Miami) = 23.5 mi.					
Pop. at risk (thousands)		Mortalities (thousands)					
		1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Rough Calc.	871	11	13	15	18	22	78
Detail Calc.	253	13	17	24	33	44	97

<u>MacDill AFB, Tampa - St. Petersburg, Florida</u>		d = 9.6 mi. *					
Pop. at risk (thousands)		Mortalities (thousands)					
		1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Rough Calc.	684	7	7	35	105	191	402
Detail Calc.	702	12	16	63	108	178	367

TABLE 3 (Continued)

Westover AFB, Springfield, Chicopee, Holyoke, Massachusetts

d = 5.2 mi.

Pop. at risk (thousands)		Mortalities (thousands)					
		1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Rough Calc.	467	45	108	176	253	348	456
Detail Calc.	530	64	101	150	218	290	423

Selfridge AFB, Detroit, Michigan

d = 19.0 mi.

Pop. at risk (thousands)		Mortalities (thousands)					
		1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Rough Calc.	3538	35	35	35	35	35	566
Detail Calc.	1277	25	38	50	94	149	425

Carswell AFB, Fort Worth, Texas

d = 6.4 mi.

Pop. at risk (thousands)		Mortalities (thousands)					
		1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Rough Calc.	513	21	61	132	198	285	509
Detail Calc.	484	43	67	103	153	212	339

McChord AFB, Tacoma, Washington

d = 5.1 mi.

Pop. at risk (thousands)		Mortalities (thousands)					
		1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Rough Calc.	274	24	60	91	131	190	251
Detail Calc.	408	31	51	87	125	173	274

* Weighted distance

2. Adjust the mortality figures for other large places in accordance with the detailed figures (size and distance from GZ). Thus we proportion:

Base Number

1	Tucson like Wichita
7	Topeka like Fort Worth
10	Lincoln like Wichita
11	Omaha like Tampa-St. Petersburg
21	Little Rock like Spokane
26	Orlando like Tampa-St. Petersburg
33	Shreveport like Fort Worth
47	Utica like Spokane
51	Columbus like Spokane
52	Dayton like Tampa-St. Petersburg;
	Springfield like Miami

The details of these adjustments as applied to the rough computations are found in Appendix C. The summation of results appears in the following table. Table 2 is reproduced to facilitate comparisons between calculation methods.

TABLE 4

ADJUSTED DETAILED CALCULATIONS

<u>Pop. at risk</u> <u>(Millions)</u>	<u>Mortalities (Millions)</u>					
	<u>1 MT</u>	<u>2 MT</u>	<u>4 MT</u>	<u>8 MT</u>	<u>16 MT</u>	<u>64 MT</u>
12.04	1.15	1.69	2.43	3.47	4.77	7.58
% 100	9.5	14.0	20.2	28.9	39.6	63.0

ROUGH CALCULATIONS

<u>Pop. at risk</u> <u>(Millions)</u>	<u>Mortalities (Millions)</u>					
	<u>1 MT</u>	<u>2 MT</u>	<u>4 MT</u>	<u>8 MT</u>	<u>16 MT</u>	<u>64 MT</u>
14.00	0.83	1.41	2.23	3.32	4.73	7.94
% 100	5.9	10.0	16.0	23.7	33.8	56.7

Discussion

There are many points to be made about these collateral damage computations, their meaning and usefulness. Among these are the following:

1. Concerning the calculation procedures only, it appears that further refinements (i.e., mapping each base in detail) might improve results but probably with diminishing returns, considering the additional effort required and the roughness of the model. However, it may be worthwhile to re-run the calculations to determine the effects of aiming errors (CEP's) on total damage. Even if one credits an enemy with very accurate weapons, there is the outside chance that the ground zero will occur two* or more CEP's away from the target and toward the city. This "worst case" computation might be run, say, using one-half nautical mile CEP weapons in the medium yield range (1-8 MT) and locating the ground zeros one mile nearer the cities.

2. Regardless of computational procedures, one does notice the gross inequalities of targets in terms of collateral damage. One might argue, for example, that an enemy sees all A_0 targets as being equal in value. That is, the threat to him from Lowry (Denver, 800,000 at risk) may appear the same as that from Mountain Home (9,000 at risk). One might also argue that the assigned megatonnage are equal. Here, the guess is that even if an enemy wished to assign smaller weapons to Lowry, he could not because he doesn't have them. Of course this does not mean that he must necessarily be malevolent; this has to do with targeting doctrines. However, whether malevolent or benevolent, damage at Mountain Home is small and remains so regardless of doctrine. At Denver, Detroit and other large places, this is not the case. Here, attacks with avoidance or "bonus" are clearly available. As a special feature of target inequalities, consider the elimination of some high risk bases (Figure 2). A 10% reduction in bases reduces the people at risk by 20% to 40% depending on the size of the weapon and reduces mortalities by about 40% for all size weapons. A 20% reduction in bases reduces the people at risk by 35% to 55% and mortalities by about 60%.

3. In the design of blast shelter programs, these inequalities introduce annoying problems. To someone planning a program around Lowry or Westover AFB, Mountain Home or Roswell AFB looks like it already is blast protected. In addition, the population around these remote places have other "built-in" means for protection such as easy dispersal and probably easily available equipment for improvising shelter.

4. In connection with (3) above, it is important that defense planners recognize that the cost of equal protection per capita will vary from place to place. That is, it may not be realistic to estimate the over-all costs of blast shelter programs by assigning costs regardless of locale even for shelters of equal hardness.

*There is about 95% probability that a weapon lands within a circle of two CEP radius.

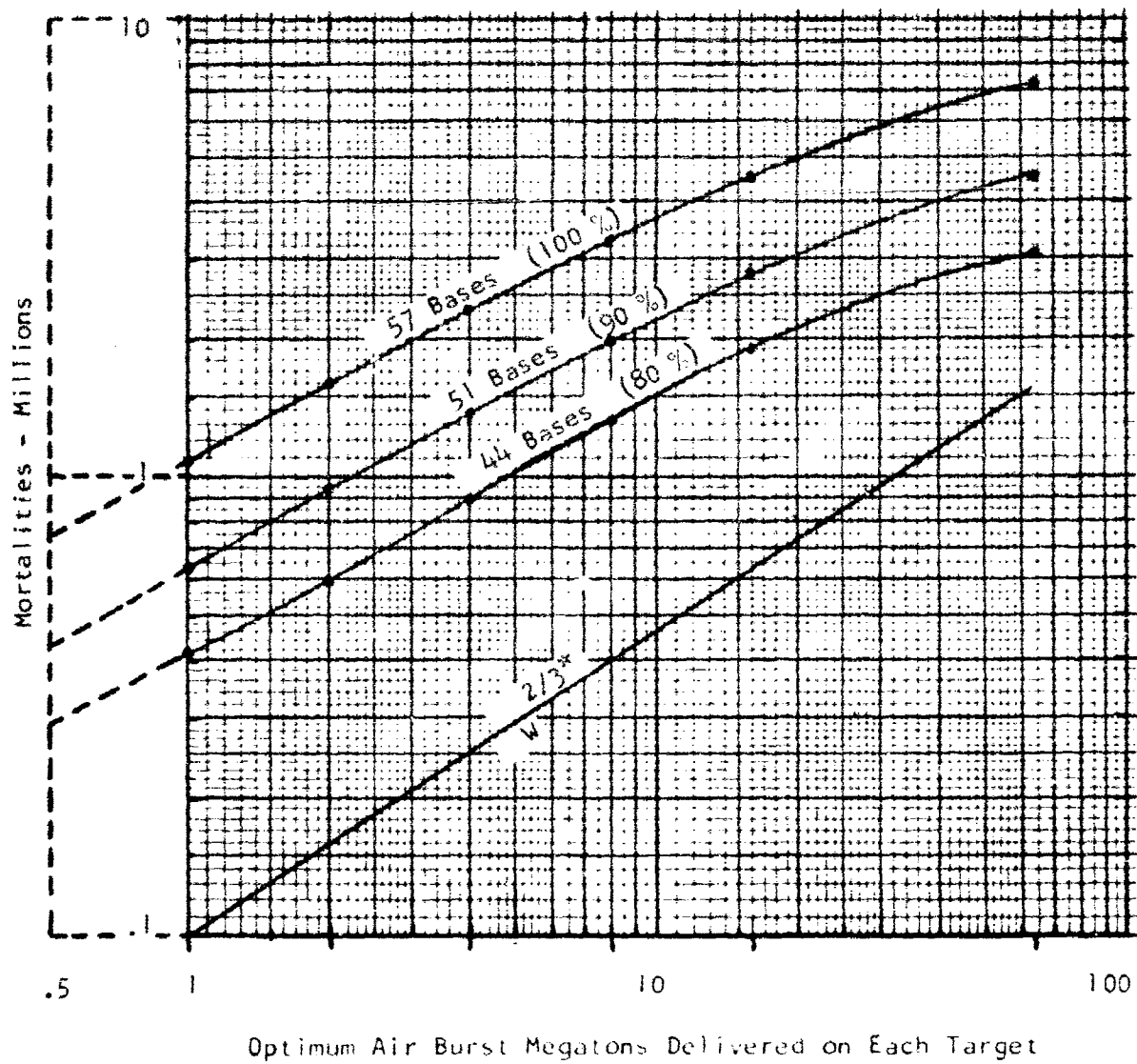


Figure 2

COLLATERAL DAMAGE RESULTS

*Slope commonly used in predicting blast damage.

5. To a first approximation the cost of a program which provides blast shelters which protect against any size weapon (or less) can be obtained by taking the cost of a required shelter space at the center of population, multiplying by the population of the area, and summing over the 57 bases. This was done for 1-MT weapons and 8-MT weapons, except that some detailed calculations were done for 10 large places and adjustments applied to other big cities. These calculations are found in Appendix D. Costs are based on the formula

$$\text{Cost per space} = \$50 + \$20 \sqrt{p}$$

where p = shelter psi rating

and 10 levels of shelter hardness (220, 100, 60, 40, 25, 20, 16, 12, 9, and 6 psi). Shelters are provided within 10 miles of GZ for the 8-MT weapon and 5 miles for the 1-MT weapon. Overpressures at greater distances are less than 5 psi and we assume blast shelters are not required. In addition, we assume that people close to GZ (< 1 mile for 8 MT and < 0.5 mile for 1 MT) are able to disperse to the shelters provided for them. Total program costs are:

For 1 MT	\$320,000,000	(approximately 2,700,000 spaces)
For 8 MT	\$825,000,000	(approximately 6,600,000 spaces)

This presumably results in zero mortalities from blast.

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APPENDIX A

COLLATERAL DAMAGE

Rough Computations

In the following tables, mortalities calculated at a target location are listed under each weapon size and are in thousands of people.

R_0 , is the radius of an equivalent circular city (miles) whose area is equal to the urban (or urbanized, if available) area of the actual city as given in the 1960 census data. d , is the distance in miles from the apparent center of the equivalent circular city to the target. The quantity $R = d - R_0$, is the distance in miles from the edge of the equivalent circular city to the target. Neither R_0 nor R is required in computing damage according to the model selected. These quantities have been found useful in checking the computations for large errors since they provide a yardstick for roughly comparing vulnerability between cities.

COLLATERAL DAMAGE

Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x103	Ro mi.	d mi.	R=d-Ro mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Ariz.	Davis-Monthan AFB	Ao										
	Tucson		227	5.3	5.5	0.2	16	45	79	114	164	227
	2 Towns		4	---	---	---	--	--	1	1	1	2
	Total State		231	---	---	---	16	45	80	115	165	229
Cal.	Vandenberg AFB	Ao										
	Lompoc		14	1.1	9.2	8.1	--	--	1	2	5	9
	6 Towns		12	---	---	---	1	1	2	3	4	7
	Beale AFB	Ao										
	Marysville		10	1.0	7.0	6.0	--	1	2	3	5	10
	Yuba City		12	1.0	8.8	7.8	--	--	1	2	4	8
	Olivehurst		5	0.6	6.7	6.1	--	1	1	2	3	5

COLLATERAL DAMAGE
Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x103	R ₀ mi.	d mi.	R=d-R ₀ mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Cal.	10 Towns		20	--	---	--	1	2	3	4	7	12
	Total State		73				2	5	10	16	28	51
Colo.	Lowry AFB	A ₀										
	Denver		804	7.3	5.2	2.1	72	193	314	450	627	804
	2 Towns		4	--	---	--	--	--	1	1	1	2
	Total State		808				72	193	315	451	628	806
Idaho	Mountain Home AFB	A ₀										
	Mountain Home		6	0.6	11.2	10.6	--	--	--	--	1	3
	2 Towns		4	--	---	--	--	--	1	1	1	2
	Total State		10				0	0	1	1	2	5

COLLATERAL DAMAGE

Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pcp. x103	R _Q mi.	d mi.	R=d·R _Q mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Kan.	Schilling AFB	A ₀										
	Salina		43	1.6	3.2	1.6	17	25	34	43	43	43
	Lindsburg		3		15.2	14.6	--	--	--	--	--	1
	13 Towns		26	---	---	---	1	2	3	5	8	16
	Forbes AFB	A ₀										
	Topeka		120	3.4	6.7	3.3	2	12	26	43	64	120
	9 Towns		18	--	---	--	1	2	2	4	6	11
	McConnell AFB	A ₀										
	Wichita		292	5.1	5.6	0.5	23	55	99	143	207	292
	Derby		6	0.6	5.0	4.4	6	2	2	4	5	6
	Mullvane		3	0.5	10.3	9.8	--	--	--	--	1	2
	Haysville		5	0.6	5.7	5.1	6	1	2	3	4	6

COLLATERAL DAMAGE

Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x103	R ₀ mi.	d mi.	R=d-R ₀ mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Kan.	3 Towns		16	--	---	---	1	1	2	3	5	10
	Total State		533				57	100	170	248	343	507
Mont.	Malinstor AFB	A ₀										
	Great Falls		58	2.0	5.2	3.2	5	14	23	32	45	58
	3 Towns		6	--	---	--	--	1	1	1	2	4
	Total State		64				5	15	24	33	47	62
Nebr.	Lincoln AFB	A ₀										
	Lincoln		135	3.4	5.1	1.7	14	34	56	79	109	136
	13 Towns		26	--	---	--	1	2	3	5	8	16

COLLATERAL DAMAGE

Megatons-Optimum Air Burst

COLLATERAL DAMAGE

Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x10 ³	R ₀ mi.	d mi.	R=d-R ₀ mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Neb.	Offutt AFB	A ₀										
	Omaha		446	5.8	9.7	3.9	4	4	22	58	134	268
	Bellevue		9	0.7	i.2	0.5	9	9	9	9	9	9
	Plattsmouth		6	0.9	8.2	7.3	--	--	1	1	2	5
	Ralston		3	0.6	5.8	4.8	--	--	1	1	2	3
	13 Towns		26	--	---	--	1	2	3	5	8	16
	Total State		652				29	51	95	158	272	453
N.M.	Walker AFB	A ₀										
	Roswell		40	1.1	6.0	4.9	2	6	12	17	25	40
	3 Towns		6	--	--	--	1	1	2	3	4	7
	Total State		46				3	7	14	20	29	47

COLLATERAL DAMAGE

Megatons--Optimum Air Burst

HI-361-RR/5

A-7

State	Target and City Name	Prior. Desig.	Pop. x103	R ₀ mi.	d mi.	R=d-R ₀ mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
N.Y.	Plattsburgh AFB	Ao										
	Plattsburgh		20	1.3	3.3	2.0	8	11	15	20	20	20
	27 Towns		54	---	---	---	3	5	7	11	18	34
	Total State		74				11	16	22	31	38	54
Okla.	Altus AFB	Ao										
	Altus		21	1.6	3.6	2.0	7	10	14	20	21	21
	10 Towns		20	---	---	---	1	2	3	4	7	2
	Total State		41				8	12	17	24	28	33
S.D.	Ellsworth AFB	Ao										
	Rapid City		42	2.2	5.0	5.8	--	--	4	12	17	34
	3 Towns		6	---	---	---	--	1	1	1	2	4
	Total State		48				0	1	5	13	19	38

COLLATERAL DAMAGE

Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x10 ³	R ₀ mi.	d mi.	R=d-R ₀ mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Wash.	Larson AFB	A ₀										
	Ephrata		7	1.0	13.4	12.4	--	--	--	--	1	3
	Moses Lake		11	1.4	6.0	4.6	1	2	3	5	7	11
	Larson AFB		5	1.0	1.8	0.8	5	5	5	5	5	5
	5 Towns		10	---	--	---	1	1	1	2	3	6
	Total State		290				18	20	24	37	58	141
Wyo.	Francis E. Warren AFB	A ₀										
	Cheyenne		44	1.8	1.8	0	42	44	44	44	44	44
	2 Towns		4	---	--	--	--	--	1	1	1	2
	Total State		48				42	44	45	45	45	46
	Total	A ₀	3022				267	520	846	1229	1758	2573

COLLATERAL DAMAGE

Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x103	Ro mi.	d mi.	R=d-Ro mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Cal.	Dixon		3	0.6	14.6	14.0	--	--	--	--	--	1
	Pittsburg		19	1.1	15.0	13.9	--	--	--	--	1	6
	Rio Vista		3	0.5	14.6	14.1	--	--	--	--	--	1
	7 Towns		14	---	---	---	1	1	2	3	5	9
	Castle AFB	A1										
	Merced		20	1.3	7.5	6.2	--	1	3	6	9	18
	Atwater		7	0.9	2.8	1.9	3	5	7	7	7	7
	11 Towns		22	---	---	---	1	2	3	5	7	14
	March AFB	A1										
	San Bernardino Riverside		378	7.4	8.8	1.4	4	4	34	76	132	260
	10 Towns		20	---	---	---	1	2	3	--	7	12
	Total State		512				11	18	59	112	184	353

COLLATERAL DAMAGE

Megatons - Optimum Air Burst

COLLATERAL DAMAGE

Megatons-Optimum Air Burst

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COLLATERAL DAMAGE

Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x103	R ₀ mi.	d mi.	R=d-R ₀ mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Fla.	MacDill AFB	A1										
	Tampa		302	5.8	8.4	2.6	3	3	30	69	115	223
	St. Petersburg		325	6.1	10.8	4.7	3	3	3	33	72	166
	Clearwater		35	1.8	18.3	16.5	--	--	--	--	--	6
	6 Towns		12	---	---	---	1	1	2	3	4	7
	Eglin AFB	A1										
	Valpariso		6	2.1	2.0	-0.1	5	6	6	6	6	6
	Ft. Walton Beach		12	1.3	6.5	5.2	--	1	3	5	7	12
	Niceville		5	0.9	3.7	2.8	2	2	4	4	5	5
	2 Towns		4	---	---	---	--	--	1	1	1	2
	Total State		1802				28	33	78	174	303	649

COLLATERAL DAMAGE

Megatons-Optimum Air Burst

COLLATERAL DAMAGE

Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x10 ³	R ₀ mi.	d mi.	R=d-R ₀ mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Ga.	Turner AFB	A1										
	Albany		58	2.8	4.0	1.2	15	23	33	46	58	58
	7 Towns		14	---	---	---	1	1	2	3	5	9
	Hunter AFB	A1										
	Savannah		170	4.4	4.4	0	32	60	82	117	162	170
	7 Towns		14	---	---	---	1	1	2	3	5	9
	Robins AFB	A1										
	Macon		114	3.3	12.8	9.5	1	1	1	6	11	46
	Warner-Robins		19	1.4	2.2	0.8	13	17	19	19	19	19
	Fort Valley		8	1.3	18.2	16.9	--	--	--	--	--	1
	Perry		6	1.8	15.0	13.2	--	--	--	--	--	2
	5 Towns		10	---	---	---	1	1	1	2	3	6
	Total State		413				64	104	140	196	263	320

Megatons-Optimum Air Burst

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COLLATERAL DAMAGE

Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x103	R ₀ mi.	d mi.	R=d-R ₀ mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Me.	Loring AFB	A1										
	Caribou		8	1.6	9.2	7.6	--	--	--	1	3	5
	Van Buren		4	0.7	13.8	13.1	--	--	--	--	--	1
	Ft. Fairfield		3	0.7	12.7	12.0	--	--	--	--	--	1
	14 Towns		28	---	---	---	1	2	4	6	9	17
	Presque Isle AFB	A1										
	Presque Isle		13	4.8	1.0	-3.8	13	13	13	13	13	13
	10 Towns		20	---	---	---	1	2	3	4	7	12
	Total State		190				56	68	75	83	100	137
Mass.	Westover AFB	A1										
	Springfield Chicopee Holyoke		450	8.7	5.2	-3.5	45	108	176	252	347	450

COLLATERAL DAMAGE
Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x103	R ₀ mi.	d mi.	R=d-R ₀ mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Mich.	Wurtsmith AFB	A1										
	8 Towns		16	--	---	---	1	1	2	3	5	10
	Kincheloe AFB	A1										
	9 Towns		18	--	---	---	1	2	2	4	6	11
	Total State		3616				38	40	41	46	54	607
Miss.	Columbus AFB	A1										
	Columbus		25	1.6	10.3	8.7	--	--	1	3	6	14
	Aberdeen		7	1.3	13.8	12.5	--	--	--	--	1	2
	West Point		9	1.0	11.7	10.7	--	--	--	--	1	4
	6 Towns		12	---	---	---	1	1	2	3	4	7
	Total State		52				1	1	3	6	12	27

COLLATERAL DAMAGE

Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x10 ³	R ₀ mi.	d mi.	R=d-R ₀ mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Mo.	Whiteman AFB	A ₁										
	Warrensburg		10	1.0	10.7	9.7	--	--	--	1	2	5
	Windsor		3	0.7	13.6	12.9	--	--	--	--	--	1
	6 Towns		12	---	---	---	1	1	2	3	4	7
	Total State		25				1	1	2	4	6	13
Mont.	Glasgow AFB	A ₁										
	Negl. Pop.		--	---	--	---	--	--	--	--	--	--
	Total State		--				0	0	0	0	0	0
N.H.	Pease AFB	A ₁										
	Portsmouth		26	2.2	3.2	1.0	10	15	21	26	26	26

COLLATERAL DAMAGE Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x103	R ₀ mi.	d mi.	R=d-R ₀ mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
N.H.	Dover		19	2.9	8.8	5.9	--	--	2	4	7	13
	Somersworth		9	1.8	13.2	11.4	--	--	--	--	1	4
	Newmarket		3	1.0	6.0	5.0	--	--	1	1	2	3
	Exeter		6	1.0	9.3	8.3	--	--	--	1	2	4
	Durham		5	0.9	6.8	5.9	--	--	1	2	3	5
	5 Towns		10	---	---	---	1	1	1	2	3	6
	Total State		78				11	16	26	36	44	61
N.Y.	Griffiss AFB	A1										
	Rome		64	5.1	2.5	-2.6	37	54	61	64	64	64
	Utica		124	3.0	12.5	9.5	1	1	1	6	14	51
	45 Towns		90	---	---	--	5	8	12	19	29	56
	Total State		278				43	63	74	89	107	171

COLLATERAL DAMAGE
Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x103	R ₀ mi.	d mi.	R=d-R ₀ mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
N.C.	Seymour Johnson AFB	A1										
	Goldsboro		29	1.5	3.2	1.7	29	29	29	29	29	29
	Mt. Olive		5	0.7	11.5	10.8	--	--	--	--	1	2
	8 Towns		16	---	---	---	1	1	2	3	5	10
	Total State		50				30	30	31	32	35	41
N.D.	Grand Forks AFB	A1										
	Grand Forks		35	1.3	17.3	16.0	--	--	--	--	1	7
	9 Towns		18	---	---	---	1	2	2	4	6	11
	Minot AFB	A1										
	Minot		31	1.5	14.2	12.7	--	--	--	--	2	10
	7 Towns		14	---	---	---	1	1	2	3	5	9
	Total State		98				2	3	4	7	14	37

COLLATERAL DAMAGE
Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x103	R ₀ mi.	d mi.	R=d-R ₀ mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Ohio	Lockbourne AFB	AI										
	Columbus		617	5.8	12.0	5.8	5	5	5	37	86	265
	Stromville		11	0.9	14.5	13.6	--	--	--	--	1	4
	Town		34	---	---	---	2	3	4	7	11	21
	Wright-Patterson AFB	AI										
	Dayton		501	5.3	9.0	2.7	5	5	40	85	170	336
	Springfield		90	2.6	14.2	11.6	1	1	1	1	5	29
	Top City		4	0.7	12.0	11.3	--	--	--	--	1	2
	Paradise		6	0.8	9.0	8.2	--	--	--	1	2	4
	Xenia		20	1.2	11.6	10.4	--	--	--	1	3	9
	Fairborn		19	0.8	2.0	1.2	15	19	19	19	19	19
	New Carlisle		4	0.7	7.8	7.1	--	--	--	--	2	3

COLLATERAL DAMAGE Megatons-Optimum Air Burst

State	Target and City Name	Prior. Desig.	Pop. x103	R ₀ mi.	d mi.	R=d-R ₀ mi.	1 MT	2 MT	4 MT	8 MT	16 MT	64 MT
Ohio	Yellow Springs		4	0.7	8.2	7.5	--	--	--	--	2	3
	13 Towns		26	---	---	---	1	2	3	5	8	16
	Total State		1336				30	36	73	156	310	711
Okla.	Clinton-Sherman AFB	A ₁										
	Elk City		8	0.9	12.6	11.7	--	--	--	--	1	4
	8 Towns		16	---	---	---	1	1	2	3	5	10
	Total State		24				1	1	2	3	6	14
Texas	Bergstrom AFB	A ₁										
	Austin		187	3.9	7.8	3.9	2	7	22	56	77	157
	12 Towns		24	---	---	---	1	2	3	5	8	15

COLLATERAL DAMAGE

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COLLATERAL DAMAGE

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APPENDIX B

COLLATERAL DAMAGE

Detail Calculations for
Ten Targets

In the following tables, d, is the distance in miles (rounded to the nearest half-mile) from the target to the geographical centers of surrounding census tracts as shown in the various volumes of National Location Code prepared by the Bureau of the Census for OCD-DOD and the National Resource Evaluation Center-OEP, 1962. Kill probabilities are assigned according to this distance and the data given in Table I located in the main section of this report. This assumes that the damage to the entire census tract is equal to the damage at its center. The computations were simplified by grouping equidistant tracts.

TABLE 1
COLLATERAL DAMAGE COMPUTATIONS
(Lowry Air Force Base, Denver, Colorado)

Dist. d, Mi.	No. Tracts	Total Pop.	1 MT		2 MT		4 MT	
			P_k	Mort	P_k	Mort	P_k	Mort
0.0	1	5500	1	5500	1	5500	1	5500
0.5	--	--	1	--	1	--	1	--
1.0	2	5800	1	5800	1	5800	1	5800
1.5	7	37900	.95	36000	1	37900	1	37900
2.0	8	35900	.80	28700	.95	34100	1	35900
2.5	9	41600	.58	24100	.85	35400	.95	39500
3.0	9	44300	.43	19000	.63	27900	.90	39900
3.5	6	26800	.35	9400	.50	13400	.70	18800
4.0	8	32100	.26	8300	.40	12800	.57	18300
4.5	10	42500	.18	7700	.34	14500	.46	19600
5.0	10	61100	.11	6700	.28	17100	.40	24400
5.5	11	48700	.07	3400	.20	9700	.35	17000
6.0	7	22700	.06	1400	.15	3400	.30	6800
6.5	6	28100	.03	800	.11	3100	.24	6700
7.0	8	31900	--	--	.08	2600	.20	6400
7.5	7	37700	--	--	.04	1500	.15	5700
8.0	8	49200	--	--	--	--	.10	4900
8.5	4	29100	--	--	--	--	.09	2600
9.0	9	47600	--	--	--	--	.08	3800
9.5	6	32900	--	--	--	--	.06	2000
10.0	6	31200	--	--	--	--	.04	1200
10.5	2	13700						
11.0	3	20300						
11.5	2	11400						
12.0	--	--						
12.5	3	20200						
13.0	3	20100						
13.5	2	17600						
14.0	2	7200						
14.5	--	--						
15.0	--	--						
15.5	--	--						
16.0	1	2600						
16.5	--	--						
17.0	--	--						
17.5	1	4000						
18.0	1	3200						
18.5	--	--						
19.0	--	--						
19.5	--	--						
20.0	--	--						
TOTALS	162	312900	--	156800		224700		302700

Notes:

1. Population and Mortalities in thousands.
2. Kill Probability (P_k) for optimum air burst

(CONT'D.)

TABLE 1 (cont'd.)
 COLLATERAL DAMAGE COMPUTATIONS
 (Lowry Air Force Base, Denver, Colorado)

Dist. d Mi.	No. Tracts	Total Pop.	8 MT		16 MT		64 MT	
			Pk	Mort.	Pk	Mort.	Pk	Mort.
0.0	1	5500	1	5500	1	5500	1	5500
0.5	--	--	1	--	1	--	1	--
1.0	2	5800	1	5800	1	5800		5800
1.5	7	37900	1	37900	1	37900		37900
2.0	8	35900	1	35900	1	35900	1	35900
2.5	9	41600	1	41600	1	41600	1	41600
3.0	9	44300	1	44300	1	44300	1	44300
3.5	6	26800	.95	25500	1	26800	1	26800
4.0	8	32100	.80	25700	1	32100	1	32100
4.5	10	42500	.67	28500	.95	40400	1	42500
5.0	10	61100	.58	35400	.83	50700	1	61100
5.5	11	48700	.50	24400	.72	35100	1	48700
6.0	7	22700	.43	9800	.62	14100	1	22700
6.5	6	28100	.38	10700	.55	15500	1	28100
7.0	8	31900	.34	10800	.49	15600	.95	30300
7.5	7	37700	.31	11700	.44	16600	.90	33900
8.0	8	49200	.28	13800	.40	19700	.80	39400
8.5	4	29100	.22	6400	.36	10500	.72	21000
9.0	9	47600	.17	8100	.34	16200	.67	31900
9.5	6	32900	.14	4600	.31	10200	.61	20100
10.0	6	31200	.11	3400	.27	8400	.56	17500
10.5	2	13700	.10	1400	.23	3200	.53	7300
11.0	3	20300	.09	1800	.20	4100	.49	9900
11.5	2	11400	.07	800	.17	1900	.45	5100
12.0	--	--	.06	--	.14	--	.43	--
12.5	3	20200	.05	1000	.11	2200	.41	8300
13.0	3	20100	.04	800	.09	1800	.39	7800
13.5	2	17600	--	--	.08	1400	.37	6500
14.0	2	7200			.07	500	.35	2500
14.5	--	--			.06	--	.33	--
15.0	--	--			.05	--	.31	--
15.5	--	--			.05	--	.30	--
16.0	1	2600			.04	100	.28	700
16.5	--	--					.25	--
17.0	--	--					.23	--
17.5	1	4000					.20	800
18.0	1	3200					.18	600
18.5	--	--					.16	--
19.0	--	--					.14	--
19.5	--	--					.12	--
20.0	--	--					.10	--
TOTALS	162	812900	--	395600	--	498100	--	676600

TABLE 2
COLLATERAL DAMAGE COMPUTATIONS
(McConnell Air Force Base,
Wichita, Kansas)

Dist. d Mi.	No. Tracts	Tot. Pop.	1 MT		2 MT		4 MT	
			P _k	Mort.	P _k	Mort.	P _k	Mort.
0.0	1	2000	1	2000	1	2000	1	2000
0.5	---	----	1	----	1	----	1	----
1.0	---	----	1	----	1	----	1	----
1.5	3	12800	.95	12200	1	12800	1	12800
2.0	3	7300	.80	5800	.95	6900	1	7300
2.5	3	16500	.58	9600	.85	14000	.95	15700
3.0	4	12900	.43	5500	.63	8100	.90	11600
3.5	4	19200	.35	6700	.50	9600	.70	13400
4.0	9	32800	.26	8500	.40	13100	.57	18700
4.5	8	24500	.18	4400	.34	8300	.46	11300
5.0	8	38100	.11	4200	.28	10700	.40	15200
5.5	7	19300	.07	1400	.20	3900	.35	6800
6.0	6	22600	.06	1400	.15	3400	.30	6800
6.5	6	22800	.03	700	.11	2500	.24	5500
7.0	6	28800			.08	2300	.20	5800
7.5	3	8700			.04	300	.15	1300
8.0	4	14500					.10	1500
8.5	4	10500					.09	900
9.0	3	11000					.08	900
9.5	2	5300					.06	300
10.0	2	4000					.04	200
10.5	---	----						
11.0	1	3700						
11.5	---	----						
12.0	2	1300						
12.5	1	4100						
13.0	1	2200						
13.5	2	5900						
14.0	4	6500						
14.5	2	3500						
15.0	---	----						
15.5	---	----						
16.0	1	100						
16.5	---	----						
17.0	---	----						
17.5	---	----						
18.0	4	1100						
18.5	---	----						
19.0	4	17300						
19.5	---	----						
20.0	2	2600						
TOTALS	110	361900		62400		97900		138000

Notes:

1. Population and Mortalities in thousands
2. Kill Probability (P_k) for optimum air burst

(CONT'D.)

TABLE 2 (cont'd.)
 COLLATERAL DAMAGE COMPUTATIONS
 (McConnell Air Force Base,
 Wichita, Kansas)

Dist. d Mi.	No. Tracts	Tot. Pop.	8 MT		16 MT		64 MT	
			P _k	Mort.	P _k	Mort.	P _k	Mort.
0.0	1	2000	1	2000	1	2000	1	2000
0.5	---	---	1	---	1	---	1	---
1.0	---	---	1	---	1	---	1	---
1.5	3	12800	1	12800	1	12800	1	12800
2.0	3	7300	1	7300	1	7300	1	7300
2.5	3	16500	1	16500	1	16500	1	16500
3.0	4	12900	1	12900	1	12900	1	12900
3.5	4	19200	.95	18200	1	19200	1	19200
4.0	9	32800	.80	26200	1	32800	1	32800
4.5	8	24500	.67	16400	.95	23300	1	24500
5.0	8	38100	.58	22100	.83	31600	1	38100
5.5	7	19300	.50	9700	.72	13900	1	19300
6.0	6	22600	.43	9700	.62	14000	1	22600
6.5	6	22800	.38	8700	.55	12500	1	22800
7.0	6	28800	.34	9800	.49	14100	.95	27400
7.5	3	8700	.31	2700	.44	3800	.90	7800
8.0	4	14500	.28	4100	.40	5800	.80	11600
8.5	4	10500	.22	2300	.36	3800	.72	7600
9.0	3	11000	.17	1900	.34	3700	.67	7400
9.5	2	5300	.14	700	.31	1600	.61	3200
10.0	2	4000	.11	400	.27	1100	.56	2200
10.5	---	---	.10	---	.23	---	.53	---
11.0	1	3700	.09	300	.20	700	.49	1800
11.5	---	---	.07	---	.17	---	.45	---
12.0	2	1300	.06	100	.14	200	.43	600
12.5	1	4100	.05	200	.11	500	.41	1700
13.0	1	2200	.04	100	.09	200	.39	900
13.5	2	5900			.08	500	.37	2200
14.0	4	6500			.07	500	.35	2300
14.5	2	3500			.06	200	.33	1200
15.0	---	---			.05		.31	---
15.5	---	---			.05		.30	---
16.0	1	100			.04		.28	---
16.5	---	---					.25	---
17.0	---	---					.23	---
17.5	---	---					.20	---
18.0	4	1100					.18	200
18.5	---	---					.16	---
19.0	4	17300					.14	2400
19.5	---	---					.12	---
20.0	2	2600					.10	300
TOTALS	110	361900		185100		235500		311600

TABLE 3
COLLATERAL DAMAGE COMPUTATIONS
(Fairchild Air Force Base,
Spokane, Washington)

Dist. d Mi.	No. Tracts	Tot. Pop.	1 MT		2 MT		4 MT	
			P _k	Mort.	P _k	Mort.	P _k	Mort.
0.0	1	5700	1	5700	1	5700	1	5700
0.5	---	---	1	---	1	---	1	---
1.0	---	---	1	---	1	---	1	---
1.5	---	---	1	---	1	---	1	---
2.0	---	---	.95	---	1	---	1	---
2.5	---	---	.80	---	.95	---	1	---
3.0	---	---	.58	---	.85	---	.95	---
3.5	---	---	.43	---	.63	---	.90	---
4.0	---	---	.35	---	.50	---	.70	---
4.5	1	4800	.26	1200	.40	1900	.57	2700
5.0	---	---	.18	---	.34	---	.46	---
5.5	1	800	.11	100	.28	200	.40	300
6.0	---	---	.07	---	.15	---	.35	---
6.5	---	---	.06	---	.11	---	.30	---
7.0	---	---	.03	---	.08	---	.24	---
7.5	3	6500	---	---	.04	300	.20	1300
8.0	---	---	---	---	---	---	.15	---
8.5	1	2300	---	---	---	---	.10	---
9.0	6	23700	---	---	---	---	.09	200
9.5	1	5400	---	---	---	---	.08	1900
10.0	7	30700	---	---	---	---	.06	300
10.5	5	23600	---	---	---	---	.04	1200
11.0	4	18500	---	---	---	---	---	---
11.5	4	20300	---	---	---	---	---	---
12.0	3	16400	---	---	---	---	---	---
12.5	3	10200	---	---	---	---	---	---
13.0	6	27500	---	---	---	---	---	---
13.5	3	13700	---	---	---	---	---	---
14.0	2	5000	---	---	---	---	---	---
14.5	1	1000	---	---	---	---	---	---
15.0	2	5100	---	---	---	---	---	---
15.5	---	---	---	---	---	---	---	---
16.0	1	3600	---	---	---	---	---	---
16.5	2	6100	---	---	---	---	---	---
17.0	2	3100	---	---	---	---	---	---
17.5	2	5700	---	---	---	---	---	---
18.0	---	---	---	---	---	---	---	---
18.5	2	12500	---	---	---	---	---	---
19.0	2	6900	---	---	---	---	---	---
19.5	---	---	---	---	---	---	---	---
20.0	1	3800	---	---	---	---	---	---
TOTALS	66	262900	---	7000	---	8100	---	13600

Notes:

1. Population and Mortalities in thousands
2. Kill Probability (P_k) for optimum air burst

(CONT'D.)

TABLE 3 (cont'd.)
COLLATERAL DAMAGE COMPUTATIONS
(Fairchild Air Force Base,
Spokane, Washington)

Dist. d Mi.	No. Tracts	Tot. Pop.	8 MT		16 MT		64 MT	
			Pk	Mort.	Pk	Mort.	Pk	Mort.
0.0	1	5700	1	5700	1	5700	1	5700
0.5	---	---	1	---	1	---	1	---
1.0	---	---	1	---	1	---	1	---
1.5	---	---	1	---	1	---	1	---
2.0	---	---	1	---	1	---	1	---
2.5	---	---	1	---	1	---	1	---
3.0	---	---	1	---	1	---	1	---
3.5	---	---	1	---	1	---	1	---
4.0	1	4800	.95	---	1	---	1	---
4.5	---	---	.80	3800	1	4800	1	4800
5.0	1	800	.67	---	.95	---	1	---
5.5	---	---	.58	500	.83	700	1	800
6.0	---	---	.50	---	.72	---	1	---
6.5	---	---	.43	---	.62	---	1	---
7.0	3	6500	.38	---	.55	---	1	---
7.5	---	---	.34	2200	.49	3200	.95	6200
8.0	---	---	.31	---	.44	---	.90	---
8.5	1	2300	.28	---	.40	---	.80	---
9.0	6	23700	.22	500	.36	800	.72	1700
9.5	1	5400	.17	4000	.34	8100	.67	15900
10.0	7	30700	.14	800	.31	1700	.61	3300
10.5	5	23600	.11	3400	.27	8300	.56	17200
11.0	4	18500	.10	2400	.23	5400	.53	12500
11.5	4	20300	.09	1700	.20	3700	.49	9100
12.0	3	16400	.07	1400	.17	3500	.45	9100
12.5	3	10200	.06	1000	.14	2300	.43	7100
13.0	6	27500	.05	500	.11	1100	.41	4200
13.5	3	13700	.04	1100	.09	2500	.39	10700
14.0	2	5000			.08	2200	.37	10200
14.5	1	1000			.07	400	.35	1800
15.0	2	5100			.06	100	.33	300
15.5	---	---			.05	300	.31	1600
16.0	1	3600			.05	---	.30	---
16.5	2	6100			.04	100	.28	1000
17.0	2	3100					.25	1500
17.5	2	5700					.23	700
18.0	---	---					.20	1100
18.5	2	12500					.18	---
19.0	2	6900					.16	2000
19.5	---	---					.14	100
20.0	1	3800					.12	---
TOTALS	66	262900		29000		52400		129900

TABLE 4
COLLATERAL DAMAGE COMPUTATIONS
(March Air Force Base,
San Bernardino-Riverside, California)

Dist. d Mi.	No. Tracts	Tot. Pop.	1 MT		2 MT		4 MT	
			Pk	Mort.	Pk	Mort.	Pk	Mort.
0.0	1	5800	1	5800	1	5800	1	5800
0.5	---	---	1	---	1	---	1	---
1.0	---	---	1	---	1	---	1	---
1.5	---	---	.95	---	1	---	1	---
2.0	---	---	.80	---	.95	---	1	---
2.5	---	---	.58	---	.85	---	.95	---
3.0	1	7300	.43	3100	.63	4600	.90	6600
3.5	---	---	.35	---	.50	---	.70	---
4.0	---	---	.26	---	.40	---	.57	---
4.5	---	---	.18	---	.34	---	.46	---
5.0	---	---	.11	---	.28	---	.40	---
5.5	2	7600	.07	500	.20	1500	.35	2700
6.0	---	---	.06	---	.15	---	.30	---
6.5	1	5300	.03	200	.11	600	.24	1300
7.0	3	8800			.08	700	.20	1800
7.5	4	16000			.04	600	.15	2400
8.0	5	29200					.10	2900
8.5	3	11000					.09	1000
9.0	4	19600					.08	1600
9.5	1	4300					.06	300
10.0	1	2000					.04	100
10.5	1	5300						
11.0	6	26300						
11.5	2	7700						
12.0	4	16000						
12.5	4	13200						
13.0	4	11600						
13.5	2	8100						
14.0	6	27500						
14.5	7	20600						
15.0	7	19700						
15.5	9	40000						
16.0	7	27500						
16.5	10	49000						
17.0	4	16100						
17.5	4	20200						
18.0	5	39200						
18.5	---	---						
19.0	1	3700						
19.5	---	---						
20.0	1	1300						
TOTALS	110	469900		9600		13800		26500

Notes:

1. Population and Mortalities in thousands
2. Kill Probability (P_k) for optimum air burst

(CONT'D.)

TABLE 4 (cont'd.)
 COLLATERAL DAMAGE COMPUTATIONS
 (March Air Force Base,
 San Bernardino-Riverside, California)

Dist. d Mi.	No. Tracts	Tot. Pop.	8 MT		16 MT		64 MT	
			P _k	Mort.	P _k	Mort.	P _k	Mort.
0.0	1	5800	1	5800	1	5800	1	5800
0.5	---	----	1	----	1	----	1	----
1.0	---	----	1	----	1	----	1	----
1.5	---	----	1	----	1	----	1	----
2.0	---	----	1	----	1	----	1	----
2.5	---	----	1	----	1	----	1	----
3.0	1	7300	1	7300	1	7300	1	7300
3.5	---	----	.95	----	1	----	1	----
4.0	---	----	.80	----	1	----	1	----
4.5	---	----	.67	----	.95	----	1	----
5.0	---	----	.58	----	.33	----	1	----
5.5	2	7600	.50	3800	.72	5500	1	7600
6.0	---	----	.43	----	.62	----	1	----
6.5	1	5300	.38	2000	.55	2900	1	5300
7.0	3	8800	.34	3000	.49	4300	.95	8400
7.5	4	16000	.31	5000	.44	7000	.90	14400
8.0	5	29200	.28	8200	.40	11700	.80	23400
8.5	3	11000	.22	2400	.36	4000	.72	7900
9.0	4	19600	.17	3300	.34	6700	.67	13100
9.5	1	4300	.14	600	.31	1300	.61	2600
10.0	1	2000	.11	200	.27	500	.56	1100
10.5	1	5300	.10	500	.23	1200	.53	2800
11.0	6	26300	.09	2400	.20	5300	.49	12900
11.5	2	7700	.07	500	.17	1300	.45	3500
12.0	4	16000	.06	1000	.14	2200	.43	6900
12.5	4	13200	.05	700	.11	1500	.41	5400
13.0	4	11600	.04	500	.09	1000	.39	4500
13.5	2	8100			.08	600	.37	3000
14.0	6	27500			.07	1900	.35	9700
14.5	7	20600			.06	1200	.33	7000
15.0	7	19700			.05	1000	.31	6100
15.5	9	40000			.05	2000	.30	12000
16.0	7	27500			.04	1100	.28	7700
16.5	10	49000					.25	12300
17.0	4	16100					.23	3700
17.5	4	20700					.20	4000
18.0	5	39200					.18	7100
18.5	---	----					.16	---
19.0	1	3700					.14	500
19.5	---	----					.12	---
20.0	1	1300					.10	100
TOTALS	110	469900		47200		149300		206100

TABLE 5
COLLATERAL DAMAGE COMPUTATIONS
(Homestead Air Force Base,
Homestead, Florida)

Dist. d Mi.	No. Tracts	Tot. Pop.	1 MT		2 MT		4 MT	
			P_k	Mort.	P_k	Mort.	P_k	Mort.
0.0	---	----	1	----	1	----	1	----
0.5	---	----	1	----	1	----	1	----
1.0	1	8300	1	8300	1	8300	1	8300
1.5	---	----	.95	----	1	----	1	----
2.0	---	----	.80	----	.95	----	1	----
2.5	---	----	.58	----	.85	----	.95	----
3.0	1	2900	.43	1200	.63	1800	.90	2600
3.5	2	4600	.35	1600	.50	2300	.70	3200
4.0	---	----	.26	----	.40	----	.57	----
4.5	1	3100	.18	600	.34	1100	.46	1400
5.0	1	2600	.11	300	.28	700	.40	1000
5.5	1	3800	.07	300	.20	800	.35	1300
6.0	---	----	.06	----	.15	----	.30	----
6.5	2	16200	.03	500	.11	1800	.24	3900
7.0	1	4200			.08	300	.20	800
7.5	2	7600			.04	300	.15	1100
8.0	---	----					.10	----
8.5	---	----					.09	----
9.0	---	----					.08	----
9.5	---	----					.06	----
10.0	1	10600					.04	400
10.5	1	4200						
11.0	---	----						
11.5	---	----						
12.0	---	----						
12.5	---	----						
13.0	2	10900						
13.5	---	----						
14.0	1	1800						
14.5	2	6100						
15.0	1	2100						
15.5	1	1500						
16.0	3	12700						
16.5	2	17200						
17.0	4	17300						
17.5	---	----						
18.0	7	36000						
18.5	3	16000						
19.0	2	8700						
19.5	4	20700						
20.0	8	34100						
TOTALS	52	253200		12800		17400		24000

Notes:

1. Population and Mortalities in thousands
2. Kill Probability (P_k) for optimum air burst

(CONT'D.)

TABLE 5 (cont'd.)
 COLLATERAL DAMAGE COMPUTATIONS
 (Homestead Air Force Base,
 Homestead, Florida)

Dist. d Mi.	No. Tracts	Tot. Pop.	8 MT		16 MT		64 MT	
			P _k	Mort.	P _k	Mort.	P _k	Mort.
0.0	---	----	1	----	1	----	1	----
0.5	---	----	1	----	1	----	1	----
1.0	1	8300	1	8300	1	8300	1	8300
1.5	---	----	1	----	1	----	1	----
2.0	---	----	1	----	1	----	1	----
2.5	---	----	1	----	1	----	1	----
3.0	1	2900	1	2900	1	2900	1	2900
3.5	2	4600	.95	4400	1	4600	1	4600
4.0	---	----	.80	----	1	----	1	----
4.5	1	3100	.67	2100	.95	2900	1	3100
5.0	1	2600	.58	1500	.83	2200	1	2600
5.5	1	3800	.50	1900	.72	2700	1	3800
6.0	---	----	.43	----	.62	----	1	----
6.5	2	16200	.38	6200	.55	8900	1	16200
7.0	1	4200	.34	1400	.49	2100	.95	4000
7.5	2	7600	.31	2400	.44	3300	.90	6800
8.0	---	----	.28	----	.40	----	.80	----
8.5	---	----	.22	----	.36	----	.72	----
9.0	---	----	.17	----	.34	----	.67	----
9.5	---	----	.14	----	.31	----	.61	----
10.0	1	10600	.11	1200	.27	2900	.56	5900
10.5	1	4200	.10	400	.23	1000	.53	2200
11.0	---	----	.09	----	.20	----	.49	----
11.5	---	----	.07	----	.17	----	.45	----
12.0	---	----	.06	----	.14	----	.43	----
12.5	---	----	.04	----	.11	----	.41	----
13.0	2	10900			.09	1000	.39	4300
13.5	---	----			.08	----	.37	----
14.0	1	1800			.07	100	.35	600
14.5	2	6100			.06	400	.33	2000
15.0	1	2100			.05	100	.31	700
15.5	1	1500			.05	----	.30	500
16.0	3	12700			.04	500	.28	3600
16.5	2	17200					.25	4300
17.0	4	17300					.23	4000
17.5	---	----					.20	----
18.0	7	36000					.18	6500
18.5	3	16000					.16	2600
19.0	2	8700					.14	1200
19.5	4	20700					.12	2500
20.0	8	34100					.10	3400
TOTALS	52	253200		32700		43900		96600

TABLE 6
COLLATERAL DAMAGE COMPUTATIONS
(MacDill Air Force Base,
Tampa, Florida)

Dist. d Mi.	No. Tracks	Tot. Pop.	1 MT		2 MT		4 MT	
			P_k	Mort.	P_k	Mort.	P_k	Mort.
0.0	1	4100	1	4100	1	4100	1	4100
0.5	---	---	1	---	1	---	1	---
1.0	---	---	1	---	1	---	1	---
1.5	---	---	.95	---	1	---	1	---
2.0	2	4700	.80	3800	.95	4500	1	4700
2.5	1	8900	.58	5200	.85	7600	.95	8500
3.0	1	4500	.43	1900	.63	2800	.90	4100
3.5	---	---	.35	---	.50	---	.70	---
4.0	2	12700	.26	3300	.40	5100	.57	7200
4.5	---	---	.18	---	.34	---	.46	---
5.0	4	18300	.11	2000	.28	5100	.40	7300
5.5	3	13300	.07	900	.20	2700	.35	4700
6.0	1	3700	.06	200	.15	600	.30	1100
6.5	2	9200	.03	300	.11	1000	.24	2200
7.0	4	14100			.08	1100	.20	2800
7.5	5	22200			.04	900	.15	3300
8.0	4	19100					.10	1900
8.5	7	31200					.09	2800
9.0	12	51600					.08	4100
9.5	8	33800					.06	2000
10.0	13	44200					.04	1800
10.5	7	27400						
11.0	4	18900						
11.5	10	44600						
12.0	8	43000						
12.5	4	23200						
13.0	7	36700						
13.5	3	13500						
14.0	3	16000						
14.5	2	4000						
15.0	6	43800						
15.5	---	---						
16.0	3	19100						
16.5	---	---						
17.0	3	13500						
17.5	---	---						
18.0	9	58600						
18.5	2	8000						
19.0	2	6800						
19.5	1	3300						
20.0	6	25500						
TOTALS	150	701500		21700		35500		62600

Notes:

1. Population and Mortalities in thousands
2. Kill Probability (P_k) for optimum air burst

(CONT'D.)

TABLE 6 (cont'd.)
COLLATERAL DAMAGE COMPUTATIONS
(MacDill Air Force Base,
Tampa, Florida)

Dist. d Mi.	No. Tracts	Tot. Pop.	8 MT		16 MT		64 MT	
			Pk	Mort.	Pk	Mort.	Pk	Mort
0.0	1	4100	1	4100	1	4100	1	4100
0.5	---	----	1	----	1	----	1	----
1.0	---	----	1	----	1	----	1	----
1.5	---	----	1	----	1	----	1	----
2.0	2	4700	1	4700	1	4700	1	4700
2.5	1	8900	1	8900	1	8900	1	8900
3.0	1	4500	1	4500	1	4500	1	4500
3.5	---	----	.95	----	1	----	1	----
4.0	2	12700	.80	10200	1	12700	1	12700
4.5	---	----	.67	----	.95	----	1	----
5.0	4	18300	.58	10600	.83	15200	1	18300
5.5	3	13300	.50	6700	.72	9600	1	13300
6.0	1	3700	.43	1600	.62	2300	1	3700
6.5	2	9200	.38	3500	.55	5100	1	9200
7.0	4	14100	.34	4800	.49	6900	.95	13400
7.5	5	22200	.31	6900	.44	9800	.90	20000
8.0	4	19100	.29	5300	.40	7600	.80	15300
8.5	7	31200	.22	6900	.36	11200	.72	22500
9.0	12	51600	.17	8800	.34	17500	.67	34600
9.5	8	33800	.14	4700	.31	10500	.61	20600
10.0	13	44200	.11	4900	.27	11900	.56	24800
10.5	7	27400	.10	2700	.23	6300	.53	14500
11.0	4	18900	.09	1700	.20	3800	.49	9300
11.5	10	44600	.07	3100	.17	7600	.45	20100
12.0	8	43000	.06	2600	.14	6000	.43	18500
12.5	4	23200	.04	900	.11	2600	.41	9500
13.0	7	36700			.09	3300	.39	14300
13.5	3	13500			.08	1100	.37	5000
14.0	3	16000			.07	1100	.35	5600
14.5	2	4000			.06	200	.33	1300
15.0	6	43800			.05	2200	.31	13600
15.5	---	----			.05	----	.30	----
16.0	3	19100			.04	800	.28	5300
16.5	---	----					.25	----
17.0	3	13500					.23	3100
17.5	---	----					.20	----
18.0	9	58600					.18	10500
18.5	2	8000					.16	1300
19.0	2	6800					.14	1000
19.5	1	3300					.12	400
20.0	6	25500					.10	2600
TOTALS	150	701500		108100		177500		366500

TABLE 7
COLLATERAL DAMAGE COMPUTATIONS
(Westover Air Force Base,
Springfield, Chicopee,
Holyoke, Mass.)

Dist. d Mi.	No. Tracts	Tot. Pop.	1 MT		2 MT		4 MT	
			P _k	Mort.	P _k	Mort.	P _k	Mort.
0.0	1	8100	1	8100	1	8100	1	8100
0.5	---	---	-	---	-	---	-	---
1.0	---	---	-	---	-	---	-	---
1.5	1	7400	.95	7000	1	7400	1	7400
2.0	2	9700	.80	7800	.95	9200	1	9700
2.5	1	5800	.58	3400	.85	4900	.95	5500
3.0	2	10600	.43	4600	.63	6700	.90	9500
3.5	5	34100	.35	11900	.50	17100	.70	23900
4.0	2	14200	.26	3700	.40	5700	.57	8100
4.5	7	58700	.18	6600	.34	20000	.46	27000
5.0	3	20800	.11	2300	.28	5800	.40	8300
5.5	3	22000	.07	1500	.20	4400	.35	7700
6.0	7	32300	.06	1900	.15	4800	.30	9700
6.5	6	32600	.03	1000	.11	3600	.24	7800
7.0	4	21800			.08	1700	.20	4400
7.5	9	44000			.04	1800	.15	6600
8.0	4	30500					.10	3100
8.5	2	16800					.09	1500
9.0	---	---					.08	---
9.5	2	11400					.06	700
10.0	4	25900					.04	1000
10.5	2	26300						
11.0	4	16000						
11.5	3	10400						
12.0	1	6500						
12.5	---	---						
13.0	3	20400						
13.5	1	4300						
14.0	3	13500						
14.5	---	---						
15.0	1	900						
15.5	---	---						
16.0	1	800						
16.5	---	---						
17.0	2	10000						
17.5	1	2200						
18.0	---	---						
18.5	1	6100						
19.0	1	2600						
19.5	---	---						
20.0	1	3500						
TOTALS	90	530200		63800		101200		130000

Notes:

1. Population and Mortalities in thousands
2. Kill Probability (P_k) for optimum air burst

(CONT'D)

TABLE 7 (Cont'd.)
COLLATERAL DAMAGE COMPUTATIONS
(Westover Air Force Base,
Springfield, Chicopee,
Holyoke, Mass.)

Dist. d Mi.	No. Tracts	Tot. Pop.	8 MT		16 MT		64 MT	
			P _k	Mort.	P _k	Mort.	P _k	Mort.
0.0	1	8100	1	8100	1	8100	1	8100
0.5	---	----	-	----	-	----	-	----
1.0	---	----	-	----	-	----	-	----
1.5	1	7400	1	7400	1	7400	1	7400
2.0	2	9700	1	9700	1	9700	1	9700
2.5	1	5800	1	5800	1	5800	1	5800
3.0	2	10600	1	10600	1	10600	1	10600
3.5	5	34100	.95	32400	1	34100	1	34100
4.0	2	14200	.80	11400	1	14200	1	14200
4.5	7	58700	.67	39300	.95	55800	1	58700
5.0	3	20800	.58	12100	.83	17300	1	20800
5.5	3	22000	.50	11000	.72	15800	1	22000
6.0	7	32300	.43	13900	.62	20000	1	32300
6.5	6	32600	.38	12400	.55	17900	1	32600
7.0	4	21800	.34	7400	.49	10700	.95	20700
7.5	9	44000	.21	13600	.44	19400	.90	39600
8.0	4	30500	.28	8500	.40	12200	.80	24400
8.5	2	16800	.22	3700	.36	6000	.72	12100
9.0	---	----	.17	----	.34	----	.67	----
9.5	2	11400	.14	1600	.31	3500	.61	7600
10.0	4	25900	.11	2800	.27	7000	.56	14500
10.5	2	26300	.10	2600	.23	6000	.53	13900
11.0	4	16000	.09	1400	.20	3200	.49	7800
11.5	3	10400	.07	700	.17	1800	.45	4700
12.0	1	6500	.06	400	.14	900	.43	2800
12.5	---	----	.05	----	.11	----	.41	----
13.0	3	20400	.04	800	.09	1800	.39	8000
13.5	1	4300			.07	300	.37	1600
14.0	3	13500			.06	800	.35	4700
14.5	---	----			.05	----	.33	----
15.0	1	900			.05	----	.31	300
15.5	---	----			.04	----	.30	----
16.0	1	800					.28	200
16.5	---	----					.25	----
17.0	2	10000					.23	2300
17.5	1	2200					.20	400
18.0	---	----					.18	----
18.5	1	6100					.16	1000
19.0	1	2600					.14	400
19.5	---	----					.12	----
20.0	1	3500					.10	400
TOTALS	90	530700		217600		290300		423100

TABLE 3
COLLATERAL DAMAGE COMPUTATION
(Geddis Air Force Base,
Detroit, Michigan)

Dist. d Mi.	No. Tracts	Tot. Pop.	1 MT		2 MT		4 MT	
			Pk	Mort.	Pk	Mort.	Pk	Mort.
0.0	1	3900	1	3900	1	3900	1	3900
0.5	---	----	1	----	1	----	1	----
1.0	---	----	1	----	1	----	1	----
1.5	---	----	.95	----	1	----	1	----
2.0	2	9300	.80	7400	.95	8800	1	----
2.5	---	----	.58	----	.85	----	.95	----
3.0	3	13900	.43	6000	.63	8800	.90	12500
3.5	2	11500	.35	4000	.50	5800	.70	8100
4.0	1	5400	.26	1400	.40	2200	.57	3100
4.5	1	8900	.18	1600	.34	3000	.46	4100
5.0	1	3300	.11	400	.28	900	.40	1300
5.5	1	3400	.07	200	.20	200	.35	1200
6.0	3	19400	.06	100	.15	2900	.30	5800
6.5	1	1300	.03		.11	100	.24	300
7.0	2	10000			.08	800	.20	2000
7.5	3	7300			.04	300	.15	1100
8.0	2	10700					.10	1100
8.5	3	17900					.09	1600
9.0	4	26400					.08	2100
9.5	1	14600					.06	900
10.0	3	17800					.04	700
10.5	4	18900						
11.0	5	40600						
11.5	4	25600						
12.0	5	34200						
12.5	7	52800						
13.0	---	----						
13.5	4	29800						
14.0	3	15100						
14.5	4	25800						
15.0	16	77400						
15.5	5	31900						
16.0	17	93800						
16.5	10	51200						
17.0	13	69100						
17.5	17	83300						
18.0	19	86800						
18.5	17	80200						
19.0	26	128100						
19.5	13	57800						
20.0	19	89900						
TOTALS	242	1277300		25000		37700		49800

Notes:

1. Population and Mortalities in thousands
2. Kill Probability (Pk) for optimum air burst

(CONT'D.)

TABLE 8 (cont'd.)
COLLATERAL DAMAGE COMPUTATIONS
(Selfridge Air Force Base,
Detroit, Michigan)

Dist. d Mi.	No. Tracts	Tot. Pop.	8 MT		16 MT		64 MT	
			Pk	Mort.	Pk	Mort.	Pk	Mort.
0.0	1	3900	1	3900	1	3900	1	3900
0.5	---	----	1	----	1	----	1	----
1.0	---	----	1	----	1	----	1	----
1.5	---	----	1	----	1	----	1	----
2.0	2	9300	1	9300	1	9300	1	9300
2.5	---	----	1	----	1	----	1	----
3.0	3	13900	1	13900	1	13900	1	13900
3.5	2	11500	.95	10900	1	11500	1	11500
4.0	1	5400	.80	4300	1	5400	1	5400
4.5	1	8900	.67	6000	.95	8500	1	8900
5.0	1	3300	.58	1900	.83	2700	1	3300
5.5	1	3400	.50	1700	.72	2400	1	3400
6.0	3	19400	.43	8300	.62	12000	1	19400
6.5	1	1300	.38	500	.55	700	1	1300
7.0	2	10000	.34	3400	.49	4900	.95	9500
7.5	3	7300	.31	2300	.44	3200	.90	6600
8.0	2	10700	.28	3000	.40	4300	.80	8600
8.5	3	17900	.22	3900	.36	6400	.72	12900
9.0	4	26400	.17	4500	.34	9000	.67	17700
9.5	1	14600	.14	2000	.31	4500	.61	8900
10.0	3	17800	.11	2000	.27	4800	.56	10000
10.5	4	18900	.10	1900	.23	4300	.53	10000
11.0	5	40600	.09	3700	.20	8100	.49	20000
11.5	4	25600	.07	1800	.17	4400	.45	11500
12.0	5	34200	.06	2100	.14	4800	.43	14700
12.5	7	52800	.05	2600	.11	5800	.41	21600
13.0	---	----	.04		.09	----	.39	----
13.5	4	29800			.08	2400	.37	11000
14.0	3	15100			.07	1100	.35	5300
14.5	4	25800			.06	1500	.33	8500
15.0	16	77400			.05	3900	.31	24000
15.5	5	31900			.05	1600	.30	9600
16.0	17	93800			.04	3800	.28	26300
16.5	10	51200					.25	12800
17.0	13	69100					.23	15900
17.5	17	83300					.20	16700
18.0	19	86800					.18	15600
18.5	17	80200					.16	12800
19.0	26	128100					.14	17900
19.5	13	57800					.12	6900
20.0	19	89900					.10	9000
TOTALS	242	1277300		93900		149100		424600

TABLE 1
 POPULATION AND MORTALITIES
 (Continued)
 DISTANCE FROM BURST

Dist. d Mi.	No. Tracts	T.T. Pop.	1 MI		2 MI		4 MI	
			P_k	M. P.	P_k	M. P.	P_k	M. P.
0.0	1	6200	1	6200	1	6200		6200
0.5	---	----	---	----	---	----	---	----
1.0	---	----	---	----	---	----	---	----
1.5	1	3600	.95	3400	1	3600	1	3600
2.0	1	8400	.80	6700	.95	8000	1	8400
2.5	1	4800	.58	2800	.85	4100	.95	4600
3.0	3	17800	.43	7700	.63	11200	.90	16000
3.5	2	10400	.35	3600	.50	5200	.70	7300
4.0	3	11300	.26	2900	.40	4500	.57	6400
4.5	6	33800	.18	6100	.34	11500	.46	15500
5.0	3	13400	.11	1500	.28	3800	.40	5400
5.5	4	14000	.07	1000	.20	2800	.35	4900
6.0	3	12700	.06	800	.15	1900	.30	3800
6.5	4	14000	.03	400	.11	1500	.24	3400
7.0	5	18200			.08	1500	.20	3600
7.5	6	24000			.04	1000	.15	3600
8.0	6	25800					.10	2600
8.5	8	40000					.09	3600
9.0	5	20500					.08	1600
9.5	4	16200					.06	1000
10.0	6	23800					.04	1000
10.5	3	17300						
11.0	6	28300						
11.5	1	5900						
12.0	4	19600						
12.5	3	9900						
13.0	2	16200						
13.5	2	4800						
14.0	2	2700						
14.5	2	14400						
15.0	2	4600						
15.5	1	3700						
16.0	3	15300						
16.5	---	----						
17.0	---	----						
17.5	1	10200						
18.0	1	4300						
18.5	---	----						
19.0	1	3200						
19.5	1	2100						
20.0	1	1200						
TOTALS	108	483700		43100		66800		102500

Notes:

1. Population and Mortalities in thousands
2. Kill Probability (P_k) for optimum air burst

(CONT'D.)

TABLE 1 (Continued)
COLLATERAL DAMAGE COMPUTATIONS
(Carroll Air Force Base,
Ft. Worth, Texas)

Dist. d Mi.	No. Tracts	Tot. Pop.	8 MT		16 MT		64 MT	
			Pk	Mort.	Pk	Mort.	Pk	Mort.
0.0	1	6200	1	6200	1	6200	1	6200
0.5	---	---	---	---	---	---	---	---
1.0	---	---	---	---	---	---	---	---
1.5	1	3600	1	3600	1	3600	1	3600
2.0	1	8400	1	8400	1	8400	1	8400
2.5	1	4800	1	4800	1	4800	1	4800
3.0	3	17800	1	17800	1	17800	1	17800
3.5	2	10400	.95	9900	1	10400	1	10400
4.0	3	11300	.80	9000	1	11300	1	11300
4.5	6	33800	.67	22600	.95	32100	1	33800
5.0	3	13400	.58	7800	.83	11100	1	13400
5.5	4	14000	.50	7000	.72	10100	1	14000
6.0	3	12700	.43	5500	.62	7900	1	12700
6.5	4	14000	.38	5300	.55	7700	1	14000
7.0	5	18200	.34	6200	.49	8900	.95	17300
7.5	6	24000	.31	7400	.44	10600	.90	21600
8.0	6	25800	.28	7200	.40	10300	.80	20600
8.5	8	40000	.22	8800	.36	14400	.72	28800
9.0	5	20500	.17	3500	.34	7000	.67	13700
9.5	4	16200	.14	2300	.31	5000	.61	9900
10.0	6	23800	.11	2600	.27	6400	.56	13300
10.5	3	17900	.10	1800	.23	4100	.53	9500
11.0	6	28300	.09	2500	.20	5700	.49	13900
11.5	1	5900	.07	400	.17	1000	.45	2700
12.0	4	19600	.06	1200	.14	2700	.43	8400
12.5	3	9900	.05	500	.11	1100	.41	4100
13.0	2	16200	.04	600	.09	1500	.39	6300
13.5	2	4800			.07	300	.37	1800
14.0	2	2700			.06	200	.35	900
14.5	2	14400			.05	700	.33	4800
15.0	2	4600			.05	200	.31	1400
15.5	1	3700			.04	100	.30	1100
16.0	3	15800					.28	4400
16.5	---	---					.25	---
17.0	---	---					.23	---
17.5	1	10200					.20	2000
18.0	1	4300					.18	800
18.5	---	---					.16	---
19.0	1	3200					.14	400
19.5	1	2100					.12	300
20.0	1	1200					.10	100
TOTALS	108	483700		152900		211600		338500

TABLE 10
COLLATERAL DAMAGE COMPUTATIONS
(McChord Air Force Base,
Tacoma, Washington)

Dist. d Mi.	No. Tracts	Tot. Pop.	1 MT		2 MT		4 MT	
			P _k	Mort.	P _k	Mort.	P _k	Mort.
0.0	---	----	1	----	1	----	1	----
0.5	---	----	1	----	1	----	1	----
1.0	---	----	1	----	1	----	1	----
1.5	---	----	.95	----	1	----	1	----
2.0	1	8100	.80	6500	.95	7700	1	8100
2.5	1	6100	.58	3500	.85	5200	.95	5800
3.0	2	17000	.43	7300	.63	10700	.90	15300
3.5	1	9200	.35	3200	.50	4600	.70	6400
4.0	1	2800	.26	700	.40	1100	.57	1600
4.5	3	14500	.18	2600	.34	4900	.46	6700
5.0	6	26800	.11	2900	.28	7500	.40	10700
5.5	3	35700	.07	2500	.15	5400	.35	12500
6.0	5	17400	.06	1000	.11	1900	.30	5200
6.5	2	9800	.03	300	.08	800	.24	2400
7.0	4	18800			.04	800	.20	3800
7.5	4	16400					.15	2500
8.0	2	8500					.10	900
8.5	5	21800					.09	2000
9.0	3	15500					.08	1200
9.5	4	26700					.06	1600
10.0	4	14900					.04	600
10.5	2	7400						
11.0	---	----						
11.5	1	700						
12.0	4	13600						
12.5	4	10000						
13.0	1	8500						
13.5	1	900						
14.0	2	9900						
14.5	1	2100						
15.0	3	7400						
15.5	---	----						
16.0	1	5700						
16.5	1	3000						
17.0	1	2900						
17.5	---	----						
18.0	1	5700						
18.5	---	----						
19.0	6	36200						
19.5	---	----						
20.0	5	24000						
TOTALS	85	408100		30500		50600		87300
								(CONT'D.)

Notes:

1. Population and Mortalities in thousands
2. Kill Probability (P_k) for optimum air burst

TABLE 10 (cont'd.)
 COLLATERAL DAMAGE COMPUTATIONS
 (McChord Air Force Base,
 Tacoma, Washington)

Dist. d Mi.	No. Tracts	Tot. Pop.	8 MT		16 MT		64 MT	
			Pk	Mort.	Pk	Mort.	Pk	Mort.
0.0	---	----	1	----	1	----	1	----
0.5	---	----	1	----	1	----	1	----
1.0	---	----	1	----	1	----	1	----
1.5	---	----	1	----	1	----	1	----
2.0	1	8100	1	8100	1	8100	1	8100
2.5	1	6100	1	6100	1	6100	1	6100
3.0	2	17000	1	17000	1	17000	1	17000
3.5	1	9200	.95	8700	1	9200	1	9200
4.0	1	2800	.80	2200	1	2800	1	2800
4.5	3	14500	.67	9700	.95	13800	1	14500
5.0	6	26800	.58	15500	.83	22200	1	26800
5.5	3	35700	.50	17900	.72	25700	1	35700
6.0	5	17400	.43	7500	.62	10800	1	17400
6.5	2	9800	.38	3700	.55	5400	1	9800
7.0	4	18800	.34	6400	.49	9200	.95	17900
7.5	4	16400	.31	5100	.44	7200	.90	14800
8.0	2	8600	.28	2400	.40	3400	.80	6900
8.5	5	21800	.22	4800	.36	7800	.72	15700
9.0	3	15500	.17	2600	.34	5300	.67	10400
9.5	4	26700	.14	3700	.31	8300	.61	16300
10.0	4	14900	.11	1600	.27	4000	.56	8300
10.5	2	7400	.10	700	.23	1700	.53	3900
11.0	---	----	.09	----	.20	----	.49	----
11.5	1	700	.07	----	.17	100	.45	300
12.0	4	13600	.06	800	.14	1900	.43	5800
12.5	4	10000	.05	500	.11	1100	.41	4100
13.0	1	8500	.04	300	.09	800	.39	3300
13.5	1	900			.08	100	.37	300
14.0	2	9900			.07	700	.35	3500
14.5	1	2100			.06	100	.33	700
15.0	3	7400			.05	400	.31	2300
15.5	---	----			.05	----	.30	----
16.0	1	5700			.04	200	.28	1600
16.5	1	3000					.25	800
17.0	1	2900					.23	700
17.5	---	----					.20	----
18.0	1	5700					.18	1000
18.5	---	----					.16	----
19.0	6	36200					.14	5100
19.5	---	----					.12	----
20.0	5	24000					.10	2400
TOTALS	85	408100		125300		173400		273500

APPENDIX C

COLLATERAL DAMAGE

Adjusted Computations

The following tables are the results of adjusting the rough damage computations (Appendix A) according to the information derived from the detailed computations (Appendix B).¹ Mortalities are listed under each weapon size and are in thousands of people.

¹ Targets calculated in detail are designated by an asterisk.

Megatons - Optimum Air Burst

No.	Target and Nearest City	State	Prior. Desig.	Pop. x103	d mi.	1	2	4	8	16	64	
1	Davis-Monthan	Ariz.	A ₀									
	Tucson			254	5.5	43	69	97	130	166	219	
2	Vandenburg	Cal.	A ₀									
	Lompoc			29	9.2	1	1	3	6	10	18	
3	Beale	Cal.	A ₀									
	Marysville			52	7.0	1	4	9	12	21	39	
4	Loray	Colo.	A ₀									
	Denver			813	5.2	157	225	303	396	498	677	
5	Mountain Home	Idaho	A ₀									
	Mountain Home			11	11.2	--	--	1	1	2	6	
6	Schilling	Kan.	A ₀									
	Salina			79	3.2	20	30	41	53	56	66	

COLLATERAL DAMAGE

Megatons - Optimum Air Burst

No.	Target and Nearest City	State	Prior. Desig.	Pop. x10 ³	0 mi.	1	2	4	8	16	64		
7	Forbes	Kan.	Ao										
	Topeka			152	6.7	14	21	32	48	67	106		
8	McConnell	Kan.	Ao										
	Wichita			362	5.5	62	98	138	185	236	312		
9	Malstrom	Mont.	Ao										
	Great Falls			70	5.2	6	17	26	36	52	68		
10	Lincoln	Neb.	Ao										
	Lincoln			178	5.1	31	42	68	91	116	153		
11	Offutt	Neb.	Ao										
	Omaha			539	9.7	17	28	48	83	137	282		
12	Walker	N.M.	Ao										
	Roswell			51	6.0	3	8	15	22	32	52		

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COLLATERAL DAMAGE

Megatons - Optimum Air Burst

No.	Target and Nearest City	State	Prior. Desig.	Pop. x10 ³	d mi.	1	2	4	8	16	64		
13	Plattsburgh	N.Y.	A ₀	81	3.3	12	18	24	34	42	59		
14	Altus	Okla.	A ₀	45	3.6	9	13	19	26	31	36		
15	Elsworth	S.D.	A ₀	53	8.0	--	1	6	14	21	42		
16	Dyess	Texas	A ₀	117	6.5	4	12	28	42	62	111		
17	Fairchild	Wash.	A ₀	263	12.5	7	8	14	29	52	130		
18	Larson	Wash.	A ₀	36	6.0	8	9	10	13	18	28		
	Moses Lake												

COLLATERAL DAMAGE

Megatons - Optimum Air Burst

No.	Target and Nearest City	State	Prior. Desig.	Pop. x10 ³	d mi.	1	2	4	8	16	64	
19	Francis E. Warren	Wyo.	A ₀									
	Cheyenne			53	1.8	46	48	50	50	50	51	
	TOTAL A ₀			3238		441	658	932	1271	1669	2455	
20	Blythville	Ark.	A ₁									
	Blythville			56	3.1	12	18	24	30	34	44	
21	Little Rock	Ark.	A ₁									
	Little Rock			237	12.3	6	7	13	26	47	117	
22	Travis	Cal.	A ₁									
	Fairfield			72	5.6	2	4	10	15	24	46	
23	Castle	Cal.	A ₁									
	Merced			54	7.5	4	9	14	20	25	43	

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COLLATERAL DAMAGE

Megatons - Optimum Air Burst

No.	Target and Nearest City	State	Prior. Desig.	Pop x10 ³	d mi.	1	2	4	8	16	64		
24	March	Cal.	A1										
	San Bernardino Riverside			470	8.8	10	14	27	47	149	206		
25	Homestead	Fla.	A1										
	Miami- Homestead			253	23.5	13	17	24	33	44	92		
26	McCoy	Fla.	A1										
	Orlando			253	9.4	8	13	23	39	64	132		
27	MacDill	Fla.	A1										
	Tampa- St. Petersburg			702	9.6	22	36	63	108	178	367		
28	Eglin	Fla.	A1										
	Valpariso			30	2.0	8	10	15	18	21	28		
29	Turner	Ca.	A1										
	Albany			79	4.0	18	26	39	54	69	74		

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COLLATERAL DAMAGE

Megatons - Optimum Air Burst

No.	Target and Nearest City	State	Prior. Desig.	Pop. x10 ³	d mi.	1	2	4	8	16	64		
30	Hunter	Ga.	A1	1									
	Savannah			202	4.4	36	67	92	132	184	197		
31	Robins	Ga.	A1										
	Macon			173	12.8	17	21	23	30	36	81		
32	Barker Hill	Ind.	A1										
	Kokomo			136	11.7	2	4	8	17	32	72		
33	Barksdale	La.	A1										
	Shreveport			254	6.1	23	35	54	80	111	178		
34	Chennault	La.	A1										
	Lake Charles			145	3.8	41	58	83	108	124	132		
35	Dow	Me.	A1										
	Bangor			125	2.0	45	56	61	65	75	97		

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COLLATERAL DAMAGE

Megatons - Optimum Air Burst

No.	Target and Nearest City	State	Prior. Desig.	Pop x10 ³	d mi.	1	2	4	8	16	64		
36	Loring	Me.	A1										
	Caribou			47	9.2	1	2	4	8	13	26		
37	Presque Isle	Me.	A1										
	Presque Isle			36	1.0	15	17	18	19	22	28		
38	Westover	Mass.	A1										
	Springfield			530	5.2	64	101	150	218	290	423		
39	K. I. Sawyer	Mich.	A1										
	Marquette			48	11.7	1	2	2	4	9	22		
40	Selfridge	Mich.	A1										
	Detroit			1277	19.0	25	38	50	94	149	425		
41	Wurtsmith	Mich.	A1										
	Shelb' Towns			18	--	1	1	2	3	6	11		

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MI-361-RR/5

COLLATERAL DAMAGE

Megatons - Optimum Air Burst

No.	Target and Nearest City	State	Prior. Desig.	Pop. x10 ³	d mi.	1	2	4	8	16	64	
42	Kincheloe	Mich.	A1									
	Small Towns			20	--	1	2	2	4	7	12	
43	Columbus	Miss.	A1									
	Columbus			58	10.3	1	1	3	7	13	30	
44	Whiteman	Mo.	A1									
	Warrensburg			28	9.7	1	1	2	4	7	14	
45	Glasgow	Mont.	A1									
	Small Towns			--	--	--	--	--	--	--	--	
46	Pease	N.H.	A1									
	Portsmouth			86	3.2	12	18	29	40	48	67	
47	Griffiss	N.Y.	A1									
	Rome			103	2.5	43	63	72	77	81	91	
	Utica			102	12.5	5	6	11	22	40	100	

COLLATERAL DAMAGE

Megatons - Optimum Air Burst

No.	Target and Nearest City	State	Prior Design.	Pop. x10 ³	d mi.	1	2	4	8	16	64		
48	Seymour Johnson	N.C.	A1										
	Goldsboro			55	3.2	33	33	34	35	39	45		
49	Grand Forks	N.D.	A1										
	Grand Forks			58	17.3	1	2	2	4	8	20		
50	Minot	N.D.	A1										
	Minot			50	14.2	1	1	2	3	8	21		
51	Lockbourne	Ohio	A1										
	Columbus			7.8	12.0	19	22	39	80	144	359		
52	Wright-Patterson	Ohio	A1										
	Dayton			600	9.0	19	32	56	96	158	324		
	Springfield			127	14.2	7	9	12	17	22	49		
	Fairborn			2	2.0	17	21	21	21	21	21		

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COLLATERAL DAMAGE

Megatons-Optimum Air Burst

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No.	Target and Nearest City	State	Prior Desig.	Pop. x103	d mi.	1	2	4	8	16	64	
53	Clinton-Sherman	Okla.	A1									
	Elk City			26	12.6	1	1	2	3	7	15	
54	Bergstrom	Texas	A1									
	Austin			232	7.8	3	10	28	67	94	189	
55	Biggs	Texas	A1									
	El Paso			316	3.8	92	135	194	276	308	311	
56	Carswell	Texas	A1									
	Fort Worth			484	6.4	43	67	103	153	212	339	
57	McChord	Wash.	A1									
	Tacoma			408	5.1	31	51	87	125	173	274	
	Total A1			8799		704	1031	1499	2202	3096	5127	
57	Totals A0 + A1			12037	--	1145	1689	2431	3473	4765	7582	
	% Mortality			100		9.5	14.0	20.2	28.9	39.6	63.0	

*

*

APPENDIX D

COLLATERAL DAMAGE

Blast Shelter Cost Computations

As a first approximation the cost of a program which provides blast shelters which protect against any size weapon (or less) can be obtained by taking the cost of a required shelter space at the center of population, multiplying by the total population at risk, and summing over the 57 targets. The following tables contain the results of such computations for 1-MT weapons and 8-MT weapons, include detail calculations for 10 large places and, based on these detailed calculations, adjustments to other large places. Costs are based on the formula

$$\text{Cost per space} = \$50 + \$20 \sqrt{p}$$

Where p = shelter psi rating

and 10 levels of shelter hardness (220, 100, 60, 40, 25, 20, 16, 12, 9, and 6 psi). Shelters are provided within 10 miles of GZ for 8-MT weapons and 5 miles for 1-MT weapons. Overpressures at greater distances are less than 5 psi, and we assume that blast shelters are not required. In addition, we assume people close to GZ (≤ 1 mile for 8-MT and ≤ 0.5 mile for 1-MT) are able to disperse to shelters provided for them.

Population and distance data were taken from Appendix C. Cost figures are in millions of dollars. The number of spaces provided at each site is shown in parentheses above the cost figure.

BLAST SHELTER COSTS

(No. of Spaces $\times 10^3$)
 $\$ \times 10^6$

No.	Target and Nearest City	State	Prior. Desig.	Total Pop. $\times 10^3$	d mi.	Opt. or Air Burst	
						1 MT	8 MT
1	Davis-Monthan	Ariz.	A ₀				
	Tucson			254	5.5	(117) 13.1	(220) 28.9
2	Vandenburg	Cal.	A ₀				
	Lompuc			29	9.2	(1) 0.2	(21) 2.3
3	Beale	Cal.	A ₀				
	Marysville			52	7.0	(2) 0.3	(40) 4.4
4	Lowry	Colo.	A ₀				
	Denver			813	5.2	(334) 40.0	(693) 93.7
5	Mountain Home	Idaho	A ₀				
	Mountain Home			11	11.2	-	(2) 0.2
6	Schilling	Kan.	A ₀				
	Salina			79	3.2	(51) 5.6	(59) 8.5

*

Note: Detail cost calculations for targets designated by an asterisk (*) may be found on pages 12 through 21.

BLAST SHELTER COSTS

(No. of Spaces $\times 10^3$)
\$ $\times 10^6$

No.	Target and Nearest City	State	Prior. Desig.	Total Pop. $\times 10^3$	d mi.	Optimum Air Burst	
						1 MT	8 MT
7	Forbes	Kan.	A _O				
	Topeka			152	6.7	(34) 4.2	(100) 12.3
8	McConnell	Kan.	A _O				
	Wichita			362	5.5	(166) 18.6	(314) 41.1
9	Malstrom	Mont.	A _O				
	Great Falls			70	5.2	(1) 0.1	(67) 8.1
10	Lincoln	Neb.	A _O				
	Lincoln			178	5.1	(82) 9.2	(154) 20.2
11	Offutt	Neb.	A _O				
	Omaha			539	9.7	(41) 5.1	(226) 25.8
12	Walker	N.M.	A _O				
	Roswell			51	6.0	(1) 0.1	(47) 5.2

*

BLAST SHELTER COSTS

(No. of Spaces $\times 10^3$)
\$ $\times 10^6$

No.	Target and Nearest City	State	Prior. Desig.	Total Pop. $\times 10^3$	d mi.	Optimum Air Burst	
						1 MT	8 MT
13	Plattsburgh	N.Y.	A ₀				
	Plattsburgh			81	3.3	(29) 3.3	(48) 6.4
14	Altus	Okla.	A ₀				
	Altus			45	3.6	(26) 2.8	(33) 4.4
15	Ellsworth	S.D.	A ₀				
	Rapid City			53	8.0	(1) 0.1	(49) 5.0
16	Dyess	Texas	A ₀				
	Abilene			117	6.5	(2) 0.2	(108) 12.0
17	Fairchild	Wash.	A ₀				
	Spokane			263	12.5	(11) 2.6	(80) 9.6
18	Larson	Wash.	A ₀				
	Moses Lake			36	6.0	(7) 0.9	(23) 3.1

*

BLAST SHELTER COSTS

(No. of Spaces $\times 10^3$)
\$ $\times 10^6$

No.	Target and Nearest City	State	Prior. Desig.	Total Pop. $\times 10^3$	d mi.	Optimum Air Burst	
						1 MT	8 MT
19	Francis E. Warren	Wyo.	A ₀				
	Cheyenne			53	1.8	(49) 7.4	(50) 12.3
	TOTAL A ₀			3238		(955) 113.8	(2334) 303.5
20	Blythville	Ark.	A ₁				
	Blythville			56	3.1	(27) 3.0	(38) 5.3
21	Little Rock	Ark.	A ₁				
	Little Rock			237	12.3	(10) 2.3	(72) 8.7
22	Travis	Cal.	A ₁				
	Fairfield			72	5.6	(2) 0.2	(35) 4.2
23	Castle	Cal.	A ₁				
	Merced			54	7.5	(10) 1.3	(40) 5.1

BLAST SHELTER COSTS

(No. of Spaces $\times 10^3$
\$ $\times 10^6$)

No.	Target and Nearest City	State	Prior. Desiq.	Total Pop. x10 ³	d mi.	Optimum Air Burst	
						1 MT.	8 MT.
24	March	Cal.	A ₁				
	San Bernardino Riverside			470	8.8	(13) 2.8	(117) 14.0
25	Homestead	Fla.	A ₁				
	Miami- Homestead			253	23.5	(22) 3.1	(64) 9.3
26	McCoy	Fla.	A ₁				
	Orlando			253	9.4	(19) 2.4	(106) 12.2
27	MacDill	Fla.	A ₁				
	Tampa- St. Petersburg			702	9.6	(53) 6.6	(296) 33.7
28	Eglin	Fla.	A ₁				
	Valpariso			30	2.0	(13) 1.6	(27) 3.8
29	Turner	Ga.	A ₁				
	Albany			79	4.0	(66) 6.6	(71) 9.2

BLAST SHELTER COSTS

(No. of Spaces $\times 10^3$)
\$ $\times 10^6$

No.	Target and Nearest City	State	Prior. Desig.	Total Pop. $\times 10^3$	d mi.	Optimum Air Burst	
						1 MT	8 MT
30	Hunter	Ga.	A ₁				
	Savannah			202	4.4	(189) 18.9	(194) 25.2
31	Robins	Ga.	A ₁				
	Macon			173	12.8	(22) 2.9	(26) 4.9
32	Bunker Hill	Ind.	A ₁				
	Kokomo			136	11.7	(5) 0.7	(36) 4.1
33	Barksdale	La.	A ₁				
	Shreveport			254	6.1	(58) 7.0	(168) 20.6
34	Chennault	La.	A ₁				
	Lake Charles			145	3.8	(118) 13.2	(126) 18.1
35	Dow	Me.	A ₁				
	Bangor			125	2.0	(59) 7.8	(83) 14.4

BLAST SHELTER COSTS

(No. of Spaces $\times 10^3$)
\$ $\times 10^6$

No.	Target and Nearest City	State	Prior. Desig.	Total Pop. $\times 10^3$	d mi.	Optimum Air Burst	
						1 MT	8 MT
36	Loring	Me.	A ₁				
	Caribou			47	9.2	(3) 0.5	(22) 2.6
37	Presque Isle	Me.	A ₁				
	Presque Isle			36	1.0	(17) 3.3	(24) 6.2
38	Westover	Mass.	A ₁				
	Springfield			530	5.2	(169) 20.2	(407) 51.4
39	K.I. Sawyer	Mich.	A ₁				
	Marquette			48	11.7	(2) 0.3	(9) 1.1
40	Selfridge	Mich.	A ₁				
	Detroit			1277	19.0	(110) 7.1	(319) 21.5
41	Wurtsmith	Mich.	A ₁				
	Small Towns			18	--	(2) 0.3	(9) 1.1

BLAST SHELTER COSTS

(No. of Spaces $\times 10^3$)
 5×10^6

No.	Target and Nearest City	State	Prior. Desig.	Total Pop. $\times 10^3$	d mi.	Optimum Air Burst	
						1 MT	8 MT
42	Kincheloe	Mich.	A ₁				
	Small Towns			20	--	(2) 0.3	(9) 1.2
43	Columbus	Miss.	A ₁				
	Columbus			58	10.3	(1) 0.2	(6) 0.7
44	Whiteman	Mo.	A ₁				
	Warrensburg			28	9.7	(1) 0.2	(6) 0.7
45	Glasgow	Mont.	A ₁				
	Small Towns			--	--	--	--
46	Pease	N.H.	A ₁				
	Portsmouth			86	3.2	(30) 3.3	(70) 8.6
47	Griffiss	N.Y.	A ₁				
	Rome			103	2.5	(74) 9.0	(85) 14.1
	Utica			202	12.5	(9) 2.0	(62) 7.4

BLAST SHELTER COSTS

(No. of Spaces $\times 10^3$)
\$ $\times 10^6$

No.	Target and Nearest City	State	Prior. Desig.	Total Pop. $\times 10^3$	d mi.	Optimum Air Burst	
						1 MT	8 MT
48	Seymour Johnson	N.C.	A ₁				
	Goldsboro			55	3.2	(34) 3.8	(40) 5.8
49	Grand forks	N.D.	A ₁				
	Grand Forks			58	17.3	(2) 0.3	(9) 1.1
50	Minot	N.D.	A ₁				
	Minot			50	14.2	(1) 0.2	(7) 0.9
51	Lockbourne	Ohio	A ₁				
	Columbus			728	12.0	(31) 7.2	(221) 26.6
52	Wright-Patterson	Ohio	A ₁				
	Dayton			600	9.0	(46) 5.6	(253) 28.8
	Springfield			127	14.2	(11) 1.6	(32) 4.7
	Fairborn			21	2.0	(21) 2.6	(21) 4.3

BLAST SHELTER COSTS

(No. of Spaces $\times 10^3$)
\$ $\times 10^6$

No.	Target and Nearest City	State	Prior. Desig.	Total Pop. x10 ³	d mi.	Optimum Air Burst	
						1 MT	8 MT
53	Clinton-Sherman	Okla.	A ₁				
	Elk City			26	12.6	(2) 0.3	(9) 1.0
54	Bergstrom	Texas	A ₁				
	Austin			232	7.8	(3) 0.4	(207) 24.1
55	Biggs	Texas	A ₁				
	El Paso			316	3.8	(305) 33.7	(309) 43.2
56	Carswell	Texas	A ₁				
	Fort Worth			484	6.4	(110) 13.3	(319) 39.2
57	McChord	Wash.	A ₁				
	Tacoma			408	5.1	(85) 9.2	(270) 32.3
	Total A ₁			8799		(1757) 205.3	(4224) 521.4
57	Totals A ₀ + A ₁			12037	--	(2712) 319.1	(6558) 824.9

D-12

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Dist. d. (mi.)	8 MT				1 MT			
	Total Pop.	Shelter Hardness (psi)	Cost per Space (\$)	Total Cost (\$ x 10 ⁶)	Total Pop.	Shelter Hardness (psi)	Cost per Space (\$)	Total Cost (\$ x 10 ⁶)
0.0	---	---	---	---	---	---	---	---
0.5	---	---	---	---	5500	220	350	1.9
1.0	11300	220	350	4.0	5800	60	205	1.2
1.5	37900	100	250	9.5	37900	25	150	5.7
2.0	35900	60	205	7.4	35900	16	130	4.7
2.5	41600	40	175	7.3	41600	12	120	5.0
3.0	44300	25	150	6.6	44300	9	110	4.9
3.5	26800	20	140	3.8	26800	9	110	3.0
4.0	32100	16	130	4.2	32100	6	100	3.2
4.5	42500	16	130	5.5	42500	6	100	4.3
5.0	61100	12	120	7.3	61100	6	100	6.1
5.5	48700	12	120	5.9	LOWRY AFB DENVER, COLORADO BLAST SHELTER COSTS (\$50 + \$20 \sqrt{p} where p = psi)			
6.0	22700	9	110	2.5				
6.5	28100	9	110	3.1				
7.0	31900	9	110	3.5				
7.5	37700	9	110	4.1				
8.0	49200	6	100	4.9				
8.5	29100	6	100	2.9				
9.0	47600	6	100	4.8				
9.5	32900	6	100	3.3				
10.0	31200	6	100	3.1				
TOTALS	692600	---	---	93.7	333500	---	---	40.0

Dist. d. (mi.)	8 MT				1 MT			
	Total Pop.	Shelter Hardness (psi)	Cost per Space (\$)	Total Cost (\$ x 10 ⁶)	Total Pop.	Shelter Hardness (psi)	Cost per Space (\$)	Total Cost (\$ x 10 ⁶)
0.0	---	---	---	---	---	---	---	---
0.5	---	---	---	---	2000	220	350	0.7
1.0	2000	220	350	0.7	---	60	205	---
1.5	12800	100	250	3.2	12800	25	150	1.9
2.0	7300	60	205	1.5	7300	16	130	0.9
2.5	16500	40	175	2.9	16500	12	120	2.0
3.0	12900	25	150	1.9	12900	9	110	1.4
3.5	19200	20	140	2.7	19200	9	110	2.1
4.0	32800	16	130	4.3	32800	6	100	3.3
4.5	24500	16	130	3.2	24500	6	100	2.5
5.0	38100	12	120	4.6	38100	6	100	3.8
5.5	19300	12	120	2.3	<p>McCONNELL AFB WICHITA, KANSAS</p> <p>BLAST SHELTER COSTS (\$50 + \$20 \sqrt{p} where p = psi)</p>			
6.0	22600	9	110	2.5				
6.5	22800	9	110	2.5				
7.0	28800	9	110	3.2				
7.5	8700	9	110	1.0				
8.0	14500	6	100	1.5				
8.5	10500	6	100	1.1				
9.0	11000	6	100	1.1				
9.5	5300	6	100	0.5				
10.0	4000	6	100	0.4				
TOTALS	313600	---	---	41.1	166100	---	---	18.6

D 14

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D 14
D 14
(0.1)

8 MT

1 MT

	Total Pop.	Shelter Hardness (p.i.)	Cost per Space (c.)	Total Cost (C x 10 ³)	Total Pop.	Shelter Hardness (p.i.)	Cost per Space (c.)	Total Cost (C x 10 ³)
0.0	---	---	---	---	---	---	---	---
0.5	---	---	---	---	5700	220	350	2.0
1.0	5700	220	350	2.0	---	60	205	---
1.5	---	100	250	---	---	25	150	---
2.0	---	60	205	---	---	16	130	---
2.5	---	40	175	---	---	12	120	---
3.0	---	25	150	---	---	9	110	---
3.5	---	20	140	---	---	9	110	---
4.0	4800	16	130	0.6	4800	6	100	0.5
4.5	---	16	130	---	---	6	100	---
5.0	800	12	120	0.1	800	6	100	0.1
5.5	---	12	120	---	FAIRCHILD AFB SPOKANE, WASHINGTON BLAST SHELTER COSTS (\$50 + \$20 \sqrt{p} where p = psi)			
6.0	---	9	110	---				
6.5	---	9	110	---				
7.0	6500	9	110	0.7				
7.5	---	9	110	---				
8.0	---	6	100	---				
8.5	2300	6	100	0.2				
9.0	23700	6	100	2.4				
9.5	5400	6	100	0.5				
10.0	30700	6	100	3.1				
TOTALS	79900	---	---	9.6	11300	---	---	2.6

Dist. d. (mi.)	8 MT				1 MT			
	Total Pop.	Shelter Hardness (psi)	Cost per Space (¢)	Total Cost (\$ x 10 ⁶)	Total Pop.	Shelter Hardness (psi)	Cost per Space (¢)	Total Cost (\$ x 10 ⁶)
0.0	---	---	---	---	---	---	---	---
0.5	---	---	---	---	5800	220	350	2.0
1.0	5800	220	350	2.0	---	60	205	---
1.5	---	100	250	---	---	25	150	---
2.0	---	60	205	---	---	16	130	---
2.5	---	40	175	---	---	12	120	---
3.0	7300	25	150	1.1	7300	9	110	0.8
3.5	---	20	140	---	---	9	110	---
4.0	---	16	130	---	---	6	100	---
4.5	---	16	130	---	---	6	100	---
5.0	---	12	120	---	---	6	100	---
5.5	7600	12	120	0.9	MARCH AFB SAN BERNARDINO - RIVERSIDE CALIFORNIA BLAST SHELTER COSTS (\$50 + \$20 \sqrt{p} where p = psi)			
6.0	---	9	110	---				
6.5	5300	9	110	0.6				
7.0	8800	9	110	1.0				
7.5	16000	9	110	1.8				
8.0	29200	6	100	2.9				
8.5	11000	6	100	1.1				
9.0	19600	6	100	2.0				
9.5	4300	6	100	0.4				
10.0	2000	6	100	0.2				
TOTALS	116900	---	---	14.0	13100	---	---	2.8

Dist. d. (mi.)	8 MT				1 MT			
	Total Pop.	Shelter Hardness (psi)	Cost per Space (s)	Total Cost (5×10^6)	Total Pop.	Shelter Hardness (psi)	Cost per Space (s)	Total Cost (5×10^6)
0.0	---	---	---	---	---	---	---	---
0.5	---	---	---	---	---	220	350	---
1.0	8300	220	350	2.9	8300	60	205	1.7
1.5	---	100	250	---	---	25	150	---
2.0	---	60	205	---	---	16	130	---
2.5	---	40	175	---	---	12	120	---
3.0	2900	25	150	0.4	2900	9	110	0.3
3.5	4600	20	140	0.6	4600	9	110	0.5
4.0	---	16	130	---	---	6	100	---
4.5	3100	16	130	0.4	3100	6	100	0.3
5.0	2600	12	120	0.3	2600	6	100	0.3
5.5	3800	12	120	0.5	HOMESTEAD AFB HOMESTEAD, FLORIDA BLAST SHELTER COSTS (\$50 + \$20 \sqrt{p} where p = psi)			
6.0	---	9	110	---				
6.5	16200	9	110	1.8				
7.0	4200	9	110	0.5				
7.5	7600	9	110	0.8				
8.0	---	6	100	---				
8.5	---	6	100	---				
9.0	---	6	100	---				
9.5	---	6	100	---				
10.0	10600	6	100	1.1				
TOTALS	63900	---	---	9.3	21500	---	---	3.1

Dist. d. (mi.)	8 MT				1 MT			
	Total Pop.	Shelter Hardness (psi)	Cost per Space (\$)	Total Cost (\$ x 10 ⁶)	Total Pop.	Shelter Hardness (psi)	Cost per Space (\$)	Total Cost (\$ x 10 ⁶)
0.0	---	---	---	---	---	---	---	---
0.5	---	---	---	---	4100	220	350	1.4
1.0	4100	220	350	1.4	---	60	205	---
1.5	---	100	250	---	---	25	150	---
2.0	4700	60	205	1.0	4700	16	130	0.6
2.5	8900	40	175	1.6	8900	12	120	1.0
3.0	4500	25	150	0.7	4500	9	110	0.5
3.5	---	20	140	---	---	9	110	---
4.0	12700	16	130	1.7	12700	6	100	1.3
4.5	---	16	130	---	---	6	100	---
5.0	18300	12	120	2.2	18300	6	100	1.8
5.5	13300	12	120	1.6	MAC DILL AFB TAMPA, FLORIDA BLAST SHELTER COSTS (\$50 + \$20 \sqrt{p} where p = psi)			
6.0	3700	9	110	0.4				
6.5	9200	9	110	1.0				
7.0	14100	9	110	1.6				
7.5	22200	9	110	2.5				
8.0	19100	6	100	1.9				
8.5	31200	6	100	3.1				
9.0	51600	6	100	5.2				
9.5	33800	6	100	3.4				
10.0	44200	6	100	4.4				
TOTALS	295600	---	---	33.7	53200	---	---	6.6

Dist. d. (mi.)	8 MT				1 MT			
	Total Pop.	Shelter Hardness (psi)	Cost per Space (\$)	Total Cost (\$ x 10 ⁶)	Total Pop.	Shelter Hardness (psi)	Cost per Space (\$)	Total Cost (\$ x 10 ⁶)
0.0	---	---	---	---	---	---	---	---
0.5	---	---	---	---	8100	220	350	2.8
1.0	8100	220	350	2.8	---	60	205	---
1.5	7400	100	250	1.9	7400	25	150	1.1
2.0	9700	60	205	2.0	9700	16	130	1.3
2.5	5800	40	175	1.0	5800	12	120	0.7
3.0	10600	25	150	1.6	10600	9	110	1.2
3.5	34100	20	140	4.8	34100	9	110	3.7
4.0	14200	16	130	1.8	14200	6	100	1.4
4.5	58700	16	130	7.6	58700	6	100	5.9
5.0	20800	12	120	2.6				
5.5	22000	12	120	2.6				
6.0	32300	9	110	3.5				
6.5	32600	9	110	3.6				
7.0	21800	9	110	2.4				
7.5	44000	9	110	4.8				
8.0	30500	6	100	3.1				
8.5	16800	6	100	1.7				
9.0	---	6	100	---				
9.5	11400	6	100	1.1				
10.0	25900	6	100	2.6				
TOTALS	406700	---	---	51.4	169400	---	---	20.2

WESTOVER AFB
SPRINGFIELD, CHICOPEE,
HOLYOKE, MASS.

BLAST SHELTER COSTS
(\$50 + \$20 \sqrt{p} where p = psi)

Dist. d. (mi.)	3 MT				1 MT			
	Total Pop.	Shelter Hardness (psi)	Cost per Space (\$)	Total Cost (\$ x 10 ⁶)	Total Pop.	Shelter Hardness (psi)	Cost per Space (\$)	Total Cost (\$ x 10 ⁶)
0.0	---	---	---	---	---	---	---	---
0.5	---				3900	220	350	1.4
1.0	3900	220	350	1.4	---	60	205	---
1.5	---	100	250	---	---	25	150	---
2.0	9300	60	205	1.9	9300	16	130	1.2
2.5	---	40	175	---	---	12	120	---
3.0	13900	45	150	2.1	13900	9	110	1.5
3.5	11500	20	140	1.6	11500	9	110	1.3
4.0	5400	16	130	0.7	5400	6	100	0.5
4.5	8900	16	130	1.2	8900	6	100	0.9
5.0	3300	12	120	0.4	3300	6	100	0.3
5.5	3400	12	120	0.4	SELFRIDGE AFB DETROIT, MICHIGAN BLAST SHELTER COSTS (\$50 + \$20 \sqrt{p} where p = psi)			
6.0	19400	9	110	1.0				
6.5	1300	9	110	0.1				
7.0	10000	9	110	1.1				
7.5	7300	9	110	0.8				
8.0	10700	6	100	1.1				
8.5	17900	6	100	1.8				
9.0	26400	6	100	2.6				
9.5	14600	6	100	1.5				
10.0	17800	6	100	1.8				
TOTALS	18500	---	---	21.5	56200	---	---	7.1

Dist. d. (mi.)	8 MT				1 MT			
	Total Pop.	Shelter Hardness (psi)	Cost per Space (\$)	Total Cost (\$ x 10 ⁶)	Total Pop.	Shelter Hardness (psi)	Cost per Space (\$)	Total Cost (\$ x 10 ⁶)
0.0	---	---	---	---	---	---	---	---
0.5	---	---	---	---	6200	220	350	2.2
1.0	6200	220	350	2.2	---	60	205	---
1.5	3600	100	250	0.9	3600	25	150	0.5
2.0	8400	60	205	1.7	8400	16	130	1.1
2.5	4800	40	175	0.8	4800	12	120	0.6
3.0	17800	25	150	2.7	17800	9	110	2.0
3.5	10400	20	140	1.5	10400	9	110	1.1
4.0	11300	16	130	1.5	11300	6	100	1.1
4.5	22800	16	130	4.4	33800	6	100	3.4
5.0	13400	12	120	1.6	13400	6	100	1.3
5.5	14000	12	120	1.7	CARSWELL AFB FORT WORTH, TEXAS BLAST SHELTER COSTS (\$50 + \$20 \sqrt{p} where p = psi)			
6.0	12700	9	110	1.4				
6.5	14000	9	110	1.5				
7.0	18200	9	110	2.0				
7.5	24000	9	110	2.6				
8.0	25800	6	100	2.6				
8.5	40000	6	100	4.0				
9.0	20500	6	100	2.1				
9.5	16200	6	100	1.6				
10.0	23800	6	100	2.4				
TOTALS	318900	---	---	39.2	109700	---	---	13.3

Dist. d. (mi.)	8 MT				1 MT			
	Total Pop.	Shelter Hardness (psi)	Cost per Space (\$)	Total Cost (\$ x 10 ⁶)	Total Pop.	Shelter Hardness (psi)	Cost per Space (\$)	Total Cost (\$ x 10 ⁶)
0.0	---	---	---	---	---	---	---	---
0.5	---	---	---	---	---	220	350	---
1.0	---	220	350	---	---	60	205	---
1.5	---	100	250	---	---	25	150	---
2.0	8100	60	205	1.7	8100	16	130	1.1
2.5	6100	40	175	1.1	6100	12	120	0.7
3.0	17000	25	150	2.6	17000	9	110	1.9
3.5	9200	20	140	1.3	9200	9	110	1.0
4.0	2800	16	130	0.4	2800	6	100	0.3
4.5	14500	16	130	1.9	14500	6	100	1.5
5.0	26800	12	120	3.2	26800	6	100	2.7
5.5	35700	12	120	4.3	<p>McCHORD AFB TACOMA, WASHINGTON</p> <p>BLAST SHELTER COSTS (\$50 + \$20 \sqrt{p} where p = psi)</p>			
6.0	17400	9	110	1.9				
6.5	9800	9	110	1.1				
7.0	18800	9	110	2.1				
7.5	16400	9	110	1.8				
8.0	8600	6	100	0.9				
8.5	21800	6	100	2.2				
9.0	15500	6	100	1.6				
9.5	26700	6	100	2.7				
10.0	14900	6	100	1.5				
TOTALS	270100	---	---	32.3	84500	---	---	9.2